

## **VOLUME 2D: GOALS & OBJECTIVES FOR SPECIES FOCUS MANAGEMENT SPECIES**

### **1.0 PLANTS - SL, SO, SS**

#### **1.1 San Diego Thornmint (*Acanthomintha ilicifolia*) – Category SO**

##### **Management Units with Known Populations**

San Diego thornmint occurs primarily in chaparral, scrub, and grassland habitats in the western portion of San Diego County and Baja California, Mexico (Beauchamp 1986; SANDAG 2012; CDFW 2013). This species is an edaphic endemic restricted to clay soils or clay lenses in gabbro soils (Oberbauer and Vanderwier 1991). A total of 46 occurrences of San Diego thornmint have been recorded on Conserved Lands in the MSPA in MU2 (El Dorado Hills); MU3 (Crestridge Ecological Reserve, Dennery Ranch, Hollenbeck Canyon Wildlife Area, San Diego National Wildlife Refuge, Otay Lakes Cornerstone Lands, City of Chula Vista Central City Preserve, South Crest Properties, Bonita Meadows, Flying Dolphin Trust, Otay Mountain Ecological Reserve, Rancho Jamul Ecological Reserve, Wright's Field); MU4 (Canada de San Vicente, City of Poway Open Space, Cleveland National Forest, Mission Trails Regional Park, Simon Preserve, Sycamore Canyon and Goodan Ranch Preserves); MU5 (Ramona Grasslands Preserve); and MU6 (Black Mountain Open Space Park, Carlsbad Oaks North Habitat Conservation Area, Emerald Point Open Space, Los Penasquitos Canyon Preserve, Manchester Mitigation Bank, Rancho La Costa Habitat Conservation Area). There are 2 very large occurrences (>10,000), 9 medium-sized occurrences (>500), and 35 small occurrences.

##### **Management Rationale**

San Diego thornmint should be managed as a Species Management Focus Category SO Species due to a moderate risk of loss of significant occurrences from Conserved Lands in the MSPA and because managing vegetation alone will not ensure persistence of the species (see Vol. 1, Table 2-4). Factors contributing to status include susceptibility to disturbance from invasive species, small populations fragmented by urbanization, and endemism.

Conservation Biology Institute prepared an Adaptive Management Framework for San Diego thornmint in 2014 that includes a conceptual model, site-by-site evaluations of population status and threats, and management recommendations (CBI 2014). Primary threats to San Diego thornmint include invasive plants, altered fire regimes, habitat fragmentation, human use (trampling), and climate change. Invasive nonnative plants present a pervasive threat to San Diego thornmint. A large proportion of extant occurrences are in proximity to development, threatening the species with direct and indirect effects from urbanization, ORV use, invasive species, fire, and climate change. Small populations are particularly vulnerable to loss from these threats.

### **Management and Monitoring Approach**

The overarching goal for San Diego thornmint is to maintain large populations, enhance small populations, and establish new populations or pollinator habitat to buffer against environmental stochasticity, maintain genetic diversity, and promote connectivity, thereby enhancing resilience within and among MUs over the long term (>100 years) in native habitats.

For the 2017–2021 planning cycle, the management and monitoring approach for San Diego thornmint is to:

- (1) Inspect conserved occurrences annually to document abundance, record threats, and identify needed management actions. Implement routine management as determined during monitoring.
- (2) Continue field research to develop habitat suitability and climate change models for San Diego thornmint and other edaphic endemic plants to better understand habitat requirements and to identify and prioritize geographic areas important for connectivity and restoration.
- (3) Refine best management practices based on the results of ongoing management experiments.
- (4) Use occurrence status and threat data and best management practices to develop a section for the species in the MSP Rare Plant Management Plan that prioritizes management actions. Implement the highest priority management actions,

- (5) Prepare a section for San Diego thornmint in the MSP Seed Collection, Banking, and Bulking Plan that directs seed collection in the MSPA to ensure representation of different occurrences in the seed bank, provide propagules to preserve genetic diversity, support habitat restoration, and rescue occurrences in case of catastrophic disturbance. Implement the San Diego thornmint seed banking and bulking plan.

For details and the most up-to-date goals, objectives, and actions, go to the MSP Portal San Diego Thornmint summary page: [http://portal.sdmmp.com/view\\_species.php?taxaid=32426](http://portal.sdmmp.com/view_species.php?taxaid=32426).

### **San Diego Thornmint References**

Beauchamp, R. M. 1986. *A Flora of San Diego County, California*. Sweetwater River Press: National City, CA. 241 pp.

CBI (Conservation Biology Institute). 2014. *Adaptive Management Framework for the Endangered San Diego Thornmint, *Acanthomintha ilicifolia*, San Diego County, California*. Prepared for California Department of Fish and Wildlife Local Assistance Grant P1182113. Prepared by Conservation Biology Institute in collaboration with San Diego Management and Monitoring Program. March 2014.

CDFW (California Department of Fish and Wildlife). 2013. California Natural Diversity Database. Occurrence report, *Acanthomintha ilicifolia*. California Department of Fish and Wildlife, Sacramento, CA.

Oberbauer, T., and J. M. Vanderwier. 1991. The Vegetation and Geologic Substrate Association and Its effect on Development in Southern California. Pages 203–212 in Abbott, P. L., and W. J. Elliot (eds.), *Environmental Perils, San Diego Region*. San Diego Association of Geologists, San Diego, CA.

San Diego Association of Governments (SANDAG). 2012. 2012 vegetation map, San Diego County, CA. Prepared by AECOM.

## 1.2 Nuttall's Acmispon (*Acmispon prostratus*) – Category SO

### Management Units with Known Occurrences

Nuttall's acmispon is an annual herb found along the coast San Diego County and in northern Baja California, Mexico (CNPS 2017). There are 21 known occurrences on Conserved Lands in MUs 1 and 7, from the San Luis River mouth south to Border Fields State Park (see Table of Occurrences and online map: <http://arcg.is/2hIPSy7>). It is associated with coastal dune and open coastal sage scrub habitat (CNPS 2017).

### Management Categorization Rationale

Nuttall's acmispon should be managed as a Species Management Focus Category SL Species due to a high risk of loss from Conserved Lands in the MSPA and because managing the general vegetation community alone will not ensure persistence of the species (see Vol. 1, Table 2-4). It is at a high risk of loss as there are only 21 occurrences on Conserved Lands in a restricted distribution with limited suitable habitat and isolated occurrences vulnerable to loss of genetic diversity and extirpation as a result of environmental and demographic stochasticity or catastrophic disturbance. Threats to Nuttall's acmispon include human use, invasive nonnative plants, climate change/sea level rise, altered hydrology, and urban development (CNPS 2017).

### Management and Monitoring Approach

The overarching goal for Nuttall's acmispon is to maintain or enhance existing occurrences to ensure multiple conserved occurrences with self-sustaining populations to increase resilience to environmental and demographic stochasticity, maintain genetic diversity, and ensure persistence over the long term (>100 years) in coastal bluff and coastal dune habitats.

For the 2017–2021 planning cycle, the management and monitoring approach for Nuttall's acmispon is to:

- (1) Inspect conserved occurrences every year to document abundance, record threats, and identify needed management actions. Implement routine management as determined during monitoring.

- (2) Use occurrence status and threat data to develop a section for Nuttall's acmispon in the MSP Rare Plant Management Plan that prioritizes management actions. Implement the highest priority management actions.
- (3) Initiate preparation of a section for Nuttall's acmispon in the MSP Seed Collection, Banking, and Bulking Plan that directs seed collection in the MSPA to ensure representation of different occurrences in the seed bank, provide propagules to preserve genetic diversity, support habitat restoration, and rescue occurrences in case of catastrophic disturbance. Initiate the seed collection and banking plan.
- (4) Enhance and expand the 4 Nuttall's acmispon occurrences at Mariner's Point, South Shores, South Carlsbad State Beach, and Cardiff State Beaches and establish a new occurrence at Stony Point in Mission Bay.

For details and the most up-to-date goals, objectives, and actions, go to the MSP Portal Nuttall's Acmispon summary page: [https://portal.sdmmp.com/view\\_species.php?taxaid=820047](https://portal.sdmmp.com/view_species.php?taxaid=820047).

### **Nuttall's Acmispon References**

CNPS (California Native Plant Society) 2017. Rare Plant Program. Inventory of Rare and Endangered Plants (online edition, v8-02). California Native Plant Society, Sacramento, CA. Website <http://www.rareplants.cnps.org> [accessed 17 January 2017].

### 1.3 Shaw's Agave (*Agave shawii* var. *shawii*) – Category SL

#### Management Units with Known Occurrences

Shaw's agave occurs in maritime succulent scrub on coastal bluffs in the southwestern portion of San Diego County and in northern Baja California (Vanderplank 2012). Some occurrences consist entirely of individual unbranched rosettes and others consist of clumps or colonies of clones. The distances between occurrences are considerable in the northern range and may be impacting effective cross-pollination. Within the MSPA, there are 6 small occurrences (<500 individuals) on Conserved Lands at 6 locations in MUs 1, 6, and 7 (see Table of Occurrences and online map: <http://arcg.is/2iBBgQB>). Only the Border Field Park occurrence is considered natural in origin, with a partially natural population at Cabrillo National Park and transplanted occurrences at Tijuana Slough National Wildlife Refuge, South Carlsbad State Beach, San Elijo Lagoon Ecological Reserve, and Torrey Pines State Reserve (Vanderplank 2012). A seventh occurrence outside of the MSPA at Point Loma Naval Base is partially native in origin and is currently one of the largest occurrences in the United States with 60 individuals and approximately 1,500 rosettes (Vanderplank 2012).

#### Management Categorization Rationale

Shaw's agave should be managed as a Species Management Focus Category SL Species due to a high risk of loss from Conserved Lands in the MSPA and because managing the general vegetation community alone will not ensure persistence of the species (see Vol. 1, Table 2-4). This species is vulnerable to loss from the MSPA because of its limited distribution in 3 MUs with only 6 occurrences totaling less than 200 individuals (not including rosettes) in the MSPA (see Table of Occurrences), 4 of which are transplanted. The natural occurrence near Border Field State Park was the largest until construction of the border fence reduced it to a single individual (Vanderplank 2014).

Exacerbating the risk of loss of Shaw's agave are a lack of connectivity between occurrences, a low level of sexual reproduction and seedling establishment, and limited suitable habitat (see Vol. 3, App. 1, Species Profiles). The greatest threats to Shaw's agave are small, isolated occurrences vulnerable to loss of genetic diversity and to extirpation due to environmental stochasticity or catastrophic disturbance (Vanderplank 2012). Other threats include low levels of sexual reproduction, limited seed set and low seedling recruitment, competition with invasive nonnative

plants, and a lack of openings in maritime succulent scrub for seedling establishment. Shaw's agave can resprout following fire, and fire likely opens up vegetation for seedling establishment. However, fire suppression can lead to higher fire intensities due to increased fuel loading and might result in increased mortality.

### Management and Monitoring Approach

The overarching goal for Shaw's agave is to maintain existing occurrences to ensure multiple conserved occurrences with self-sustaining populations to increase resilience to environmental and demographic stochasticity and improve chances of persistence over the long term (>100 years) in coastal bluff, coastal sage scrub, and Torrey pine forest vegetation communities.

For the planning cycle of 2017–2021, the management and monitoring approach is to:

- (1) Inspect extant occurrences of Shaw's agave on Conserved Lands (see Table of Occurrences) using the regional rare plant IMG monitoring protocol to record abundance and collect habitat and threats covariate data to determine management needs.
- (2) Conduct routine management actions as identified through the IMG monitoring conducted in 2016 and 2021 at Shaw's agave occurrences on Conserved Lands (see Table of Occurrences). Depending on the type and level of threat, management should be conducted as needed, not necessarily every year, and using BMPs with precautions to do no harm.

For details and the most up-to-date goals, objectives, and actions, go to the MSP Portal Shaw's Agave summary page: [https://portal.sdmmp.com/view\\_species.php?taxaid=810342](https://portal.sdmmp.com/view_species.php?taxaid=810342)

### Shaw's Agave References

Vanderplank, Sula E. 2012. Conservation Plan for Shaw's Agave (*Agave shawwii* subsp. *shawii*) Agavaceae. *Rancho Santa Ana Botanic Garden Occasional Publications*.

Vanderplank, Sula E. 2014. A Conservation Plan for *Agave shawii*. *Rancho Santa Ana Botanic Garden Occasional Publications* 14.

## 1.4 San Diego Ambrosia (*Ambrosia pumila*) – Category SO

### Management Units with Known Occurrences

San Diego ambrosia is distributed from western Riverside and San Diego Counties south into Baja California, Mexico, in floodplain terraces and watershed margins of vernal pools and alkali playas (Munz 1974; Reiser 1994). The majority of occurrences are in San Diego County where there are 14 occurrences on Conserved Lands in MUs 3, 4, 6, and 8 (see Occurrence Table or online map: <http://arcg.is/2kFzHkV>). In MU3, the San Diego National Wildlife Refuge has a moderate-sized translocated occurrence and 2 small occurrences (<500 individuals), in which 1 site had a dramatic reduction in population size within 2 years. In MU4, there is a formerly very large occurrence (>200,000 individuals) at Mission Trails Regional Park that recently (in 2015) has numbered <30,000 individuals. Mission Trails Regional Park also supports 3 groupings of plants considered as 1 small occurrence and a small translocated occurrence. In MU6, there are 3 known extant occurrences, some of which have limited information on current status. These include an unknown occurrence at Black Mountain Road, small occurrences at Los Peñasquitos Canyon Open Space Preserve and Hodges Reservoir Open Space, and a moderate-sized occurrence at Santa Fe Valley Crosby Estates. There are 2 occurrences of unknown size in MU8 at Groves Open Space and Jeffreys Ranch. Two new occurrences were found in 2015 in both MU3 and MU6 as well. Plants were also salvaged and planted near Black Mountain Road in 1999, but it is unknown whether this occurrence is still extant.

### Management Categorization Rationale

San Diego ambrosia should be managed as a Species Management Focus Category SO Species due to a moderate risk of loss of significant occurrences from Conserved Lands in the MSPA and because managing vegetation alone will not ensure persistence of the species (see Vol. 1, Table 2-4). This risk assessment is based upon the substantial decline of the largest occurrence, the large proportion of small occurrences, and a high risk of threats.

A conceptual model has been developed for San Diego ambrosia that identifies threats, monitoring targets, and management actions (Hierl et al. 2007). McEachern et al. (2006) has also developed a monitoring and management plan. An important threat is invasive annual plants (McEachern et al. 2006; Hierl et al.



2007; USFWS 2010; City San Diego 2012; Martin 2013). This species is also vulnerable to loss of genetic diversity as it can reproduce asexually and there is very little gene flow between nearby occurrences so that large occurrences are required to maintain genetic diversity (McGlaughlin and Friar 2006). The large Par 4 occurrence is genetically diverse while the Kumeyaay Lake occurrence has relatively low genetic diversity and may be a result of reduced occurrence size from invasive nonnative grasses. San Diego ambrosia appears to be a poor competitor and benefits from disturbance that opens up habitat for colonization (McEachern et al. 2006). San Diego ambrosia has poor seed production and viability and may depend on clonal growth, which further limits genetic diversity and may impact the ability of this species to respond to environmental change (see review in USFWS 2010).

In the past, occurrences were impacted by trampling from hikers, bikers, equestrians, and off-highway vehicle activity (USFWS 2010). This risk has been reduced at some occurrences because of recent fencing, signage, and enforcement (City San Diego 2009, 2011; B. Miller, pers. comm.). The species also appears to tolerate some level of disturbance such as periodic mowing and trampling (T. Oberbauer, pers. comm.). Feral pigs inhabit the upper San Diego River, and if they moved downstream could negatively impact San Diego ambrosia occurrences in MU4.

### **Management and Monitoring Approach**

The overarching goal for San Diego ambrosia is to maintain or enhance existing San Diego ambrosia occurrences to ensure multiple conserved occurrences with self-sustaining populations to increase resilience to environmental and demographic stochasticity, maintain genetic diversity, and ensure persistence over the long term (>100 years) in chaparral vegetation communities.

The management approach for San Diego ambrosia is to maintain and enhance occurrence in MUs 3, 4, 6, and 8 so that, over the long term, they are large enough ( $\geq 10,000$  ramets during years of suitable growing conditions) to maintain genetic diversity (McEachern et al. 2006) and be more resilient to environmental changes. The small occurrences (<500 individuals) should be expanded to increase genetic diversity and improve chances of long-term viability. Best methods for managing invasive plants have been initiated (Kelly and Burrascano 2007; Hasselquist et al. 2009; City of San Diego 2013) and this work should continue until the BMPs are fully tested. BMPs should also be developed for expanding occurrences if invasive

plant control alone is not sufficient. Depending on feasibility, either a seed or vegetative cutting bank should be established to provide propagules for occurrence expansion and establishment, to maintain genetic diversity, and to rescue occurrences after catastrophic disturbance.

For the 2017–2021 planning cycle, the management and monitoring approach for San Diego ambrosia is to:

- (1) Annually inspect San Diego ambrosia occurrences on Conserved Lands (see Occurrence Table) using the regional rare plant IMG monitoring protocol to record abundance and collect habitat and threats covariate data to determine management needs. Conduct routine management actions identified and use BMPs with precautions to do no harm.
- (2) Prepare a section for San Diego ambrosia in the MSP Rare Plant Management Plan that prioritizes management actions to maintain large occurrences and expand  $\geq 3$  small occurrences on Conserved Lands based upon an assessment of data on occurrence status, habitat, threats, genetic data, and results of existing restoration efforts. Implement highest-priority management actions identified in the MSP Rare Plant Management Plan and monitor the effectiveness of implementation.
- (3) Prepare a section for San Diego ambrosia in the MSP Seed Collection, Banking, and Bulking Plan to preserve genetic diversity and rescue occurrences in case of catastrophic disturbance. Implement the MSP Seed Collection, Banking, and Bulking Plan to collect and store seed at a permanent seed bank and to provide propagules as needed for management-oriented research, existing population enhancement, and establishment of new occurrences.

For details and the most up-to-date goals, objectives, and actions, go to the MSP Portal San Diego Ambrosia summary page: [https://portal.sdmmp.com/view\\_species.php?taxaid=36517](https://portal.sdmmp.com/view_species.php?taxaid=36517).

## San Diego Ambrosia References

City of San Diego. 2009. City of San Diego Rare Plant Monitoring Data.

City of San Diego. 2011. City of San Diego Rare Plant Monitoring Data.

City of San Diego. 2012. City of San Diego Rare Plant Monitoring Data.

City of San Diego. 2013. City of San Diego Rare Plant Monitoring Data.

Hasselquist, Niles, Eliza Maher Hasselquist, and Deborah Rogers. 2009. *Final Report: Comparison of Vegetation Management Techniques to Support Recovery of the Federally Endangered Ambrosia pumila*. Prepared by the Center for Natural Lands Management.

Hierl, Lauren A., Janet Franklin, Douglas H. Deutschman, and Helen M. Regan. 2007. *Developing Conceptual Models to Improve the Biological Monitoring Plan for San Diego's Multiple Species Conservation Plan*. Prepared for the California Department of Fish and Game.

Kelly, Mike, and Cindy Burrascano. 2007. Lopez Canyon Willowy Monardella Project 2001 to July 2006. *Canyon News* 21:1–6.

Martin, J. 2013. *San Diego Ambrosia (Ambrosia pumila) on San Diego National Wildlife Refuge*.

McEachern, Kathryn, Bruce Pavlik, Jon Rebman, and Robert Sutter. 2006. *San Diego Multiple Species Conservation Program (MSCP) Rare Plant Monitoring Review and Revision*. Draft technical report prepared for the City of San Diego.

McGlaughlin, Mitchell E., and Elizabeth A. Friar. 2006. Clonality in the Endangered *Ambrosia pumila* (Asteraceae) Inferred from RAPD Markers; Implications for Conservation and Management. *Conservation Genetics* 8:319–330.

Munz, P. A. 1974. *A Flora of Southern California*. Berkeley, California: University of California Press.

Reiser, C. 1994. Rare Plants of San Diego County. <http://sandiego.sierraclub.org/rareplants/> Accessed 2012 and 2013.

USFWS (U.S. Fish and Wildlife Service). 2010. *Ambrosia pumila (San Diego Ambrosia) 5-Year Review: Summary and Evaluation*. Prepared by the U.S. Fish and Wildlife Service Carlsbad Fish and Wildlife Office, Carlsbad, California.

## **1.5      *Aphanisma* (*Aphanisma blitoides*) – Category SL**

### **Management Units with Known Occurrences**

*Aphanisma* is an annual herb found in alkaline areas on coastal bluffs and sandy beaches and foredunes in southern California, the Channel Islands, and northern Baja California, Mexico (Reiser 1994; Skinner and Pavlik 1994). Within the MSPA, there is 1 recently documented occurrence of *aphanisma* on Conserved Lands in MU1 at Cabrillo National Monument (see Table of Occurrences or online map: <http://arccg.is/2kFHNU1>). However, in 2015, surveys found more locations of *aphanisma* indicating there is potential for 2 occurrences at the monument (SDNHM 2017). More comprehensive surveys and mapping will be conducted in 2016 to determine the overall extent and number of occurrences at Cabrillo National Monument. Outside the MSPA, *aphanisma* occurs at San Onofre State Beach and at 2 locations on the Point Loma Naval Base (CDFW 2012; SDNHM 2013). There were reports of the species on unconserved lands near the Torrey Pines Glider Port (CDFW 2012) and Mount Soledad (T. Oberbauer, pers. comm.). Historically, the species was reported in scattered locations from San Onofre south to San Dieguito Creek and at La Jolla, Pacific Beach, San Diego Bay, Silver Strand, Tijuana River Valley, and Imperial Beach (Reiser 1994; Skinner and Pavlik 1994).

### **Management Categorization Rationale**

*Aphanisma* should be managed as a Species Management Focus Category SL Species due to a high risk of loss from Conserved Lands in the MSPA and because managing coastal bluffs, beaches, and foredunes alone will not ensure its persistence (see Vol. 1, Table 2-4). *Aphanisma* is at high risk of loss from the MSPA as it is an annual herb with limited suitable habitat and only 1 to 2 occurrences on Conserved Lands. This species is vulnerable to loss of genetic diversity and extirpation due to environmental and demographic stochasticity and catastrophic disturbance.

### **Management and Monitoring Approach**

The overarching goal for *aphanisma* is to maintain or enhance existing occurrence(s) and establish new occurrences, as needed, to ensure multiple conserved occurrences with self-sustaining populations to increase resilience to

environmental and demographic stochasticity, maintain genetic diversity, and improve chances of persistence over the long term (>100 years) in coastal bluff, coastal dune, and coastal sage scrub vegetation communities.

For the planning cycle of 2017–2021, the management and monitoring approach for aphanisma is to:

- (1) Inspect extant aphanisma occurrence on Conserved Lands (see Table of Occurrences) using the regional rare plant IMG monitoring protocol to record abundance and collect habitat and threats covariate data to determine management needs.
- (2) Conduct routine management actions as identified through the IMG and use BMPs with precautions to do no harm.
- (3) Perform multiple surveys to delineate potentially suitable habitat for new occurrences at historic locations to determine occurrence status and at existing occurrences to identify the potential for enhancement and expansion. Collect data on occurrence status, habitat, and threats, and determine management needs.
- (4) Begin preparing a section for aphanisma in the MSP Seed Collection, Banking, and Bulking Plan to preserve genetic diversity and rescue occurrences in case of catastrophic disturbance.
- (5) Begin preparing a section in the MSP Rare Plant Management Plan that prioritizes management actions to maintain and expand conserved occurrences based upon an assessment of data on occurrence status, habitat, and threats where management recommendations for reestablishment of historic occurrences and/or establishment of new occurrences are prioritized in suitable habitat as needed to achieve  $\geq 3$  occurrences with self-sustaining populations on Conserved Lands.

For details and the most up-to-date goals, objectives, and actions, go to the MSP Portal Aphanisma summary page: [https://portal.sdmmp.com/view\\_species.php?taxaid=20679](https://portal.sdmmp.com/view_species.php?taxaid=20679).

**Aphanisma References**

CDFW (California Department of Fish and Wildlife). 2012. California Natural Diversity Database. Species occurrences shapefile, accessed 2012 and 2013.

Reiser, C. 1994. *Rare Plants of San Diego County*. <http://sandiego.sierraclub.org/rareplants/> Accessed 2012 and 2013.

SDNHM (San Diego Natural History Museum). 2013. *San Diego County Plant Atlas*. <http://www.sdnhm.org/science/botany/projects> Accessed 2013.

SDNHM. 2017. *San Diego County Plant Atlas*. <http://www.sdplantatlas.org/>. Accessed 2017.

Skinner, M., and B. Pavlik. 1994. *Inventory of Rare and Endangered Vascular Plants of California*. California Native Plant Society.

## 1.6 Encinitas Baccharis (*Baccharis vanessae*) – Category SO

### Management Units with Known Occurrences

Encinitas baccharis is a dioecious shrub endemic to San Diego County. It is limited to 12 known locations on Conserved Lands within MUs 3, 4, and 6 (see Table of Occurrences and online map: <http://arcg.is/2kUb2qe>). Four of these populations have fewer than 20 plants each, and only 2 populations are known to support more than 200 individuals (SDMMP 2016). Encinitas baccharis occurs in southern maritime chaparral in the vicinity of Encinitas and is associated with dense southern mixed chaparral at more inland locations. Edaphic requirements may significantly restrict dispersal, given the limited range of this species. Soil types associated with this species include Cieneba series, Corralitos loamy sand, alluvial Huerhuero, San Miguel Exchequer, granitic, andesite rock outcrops, and soils derived from acid igneous rock (USFWS 2011).

### Management Categorization Rationale

Encinitas baccharis should be managed as a Species Management Focus Category SO Species because persistence of 1 or more significant occurrences in the MSPA is at high risk of loss without immediate management action above and beyond that of daily maintenance activities (see Vol. 1, Table 2-4) and because management of chaparral habitat alone will not ensure its persistence. Factors contributing to this status include a highly limited range, altered fire regimes, human use (road maintenance, trampling), invasive exotic plants, and urban development. This species has been transplanted locally without much success (Reiser 2001). Poor seed viability may be a factor limiting the vigor of this species.

### Management and Monitoring Approach

The overarching goal for Encinitas baccharis is to maintain or enhance existing occurrences to ensure multiple conserved occurrences with self-sustaining populations to increase resilience to environmental and demographic stochasticity, maintain genetic diversity, and ensure persistence over the long term (>100 years) in chaparral vegetation communities.

For the 2017–2021 planning period, the management and monitoring approach for Encinitas baccharis is to:

- (1) Inspect conserved occurrences every 2 years to document abundance, record threats, and identify needed management actions. Implement routine management as determined during monitoring.
- (2) Survey historical Encinitas baccharis locations to determine occurrence status; delineate potentially suitable habitat for new occurrences; identify the potential for enhancement and expansion; and collect data on occurrence status, habitat, threats, and management needs.
- (3) Use occurrence status and threat data to develop a section for the species in the MSP Rare Plant Management Plan that prioritizes management actions. Implement the highest-priority management actions.
- (4) Prepare a section for Encinitas baccharis in the MSP Seed Collection, Banking, and Bulking Plan that directs seed collection in the MSPA to ensure representation of different occurrences in the seed bank, provide propagules to preserve genetic diversity, support habitat restoration, and rescue occurrences in case of catastrophic disturbance. Implement the seed collection and banking plan.

For details and the most up-to-date goals, objectives, and actions, go to the MSP Portal Encinitas Baccharis summary page: [https://portal.sdmmp.com/view\\_species.php?taxaid=183764](https://portal.sdmmp.com/view_species.php?taxaid=183764).

### Encinitas Baccharis References

- USFWS (U.S. Fish and Wildlife Service). 2011. *Baccharis vanessae (Encinitas baccharis). 5-Year Review: Summary and Evaluation*. Prepared by US Fish and Wildlife Service, Carlsbad Fish and Wildlife Service, Carlsbad, California. December 22, 2011.
- Reiser, C. H. 2001. *Rare plants of San Diego County*. 2001 edition. Aquafir Press. Unpublished report.



## 1.7 San Diego Goldenstar (*Bloomeria clevelandii*) – Category SS

### Management Units with Known Occurrences

San Diego goldenstar is a perennial monocot plant species known from San Diego County southward into Baja California, Mexico (CNPS 2017). There are 23 known occurrences of San Diego goldenstar on Conserved Lands in MUs 3, 4, and 6 (see Table of Occurrences and online map: <http://arcg.is/2iBAGSO>). It occurs in openings within coastal sage scrub, chaparral, and valley and foothill grassland, and near vernal pools, often on clay soils. It is noted that San Diego goldenstar, formerly in the genus *Muilla*, was recently changed to *Bloomeria* (RECON 2014).

### Management Categorization Rationale

San Diego goldenstar should be managed as a Species Management Focus Category SS Species because its persistence is at lower risk of loss compared to SL and SO species; however, this species still requires species-specific management actions (see Vol. 1, Table 2-4). Threats to San Diego goldenstar include altered fire regime, human use, invasive plants, and urban development.

### Management and Monitoring Approach

The overarching goal for San Diego goldenstar is to maintain or enhance existing occurrences to ensure multiple conserved occurrences with self-sustaining populations to increase resilience to environmental and demographic stochasticity; maintain genetic diversity; and improve chances of persistence over the long term (>100 years) in chaparral, coastal sage scrub, grassland, and vernal pool/alkali playa vegetation communities.

For the 2017–2021 planning cycle, the management and monitoring approach for San Diego goldenstar is to inspect conserved occurrences every 2 years starting in 2018 to document abundance, record threats, identify needed management actions, and implement routine management as determined during monitoring.

For details and the most up-to-date goals, objectives, and actions, go to the MSP Portal San Diego Goldenstar summary page: [https://portal.sdmmp.com/view\\_species.php?taxaid=509575](https://portal.sdmmp.com/view_species.php?taxaid=509575).

**San Diego Goldenstar References**

CNPS (California Native Plant Society). 2017. Rare Plant Program. Inventory of Rare and Endangered Plants (online edition, v8-02). California Native Plant Society, Sacramento, CA. <http://www.rareplants.cnps.org> [accessed 17 January 2017].

RECON Environmental. 2014. *San Diego Goldenstar Translocation Plan for the Castlerock Project*. City of San Diego Project No 10046. Prepared for Pardee Homes. 36 pp.

## **1.8 Thread-leaved Brodiaea (*Brodiaea filifolia*) – Category SS**

### **Management Units with Known Occurrences**

Thread-leaved brodiaea is bulbiferous herb that typically occurs on gentle hillsides, valleys, and floodplains in mesic, southern needlegrass grassland, nonnative grassland and alkali grassland plant communities in association with clay, loamy sand, or alkaline silty-clay soils (USFWS 2009). Occurrences may be intermixed with, or near, vernal pool complexes and occasionally in openings in coastal sage scrub. Thread-leaved brodiaea is documented from the foothills of the San Gabriel Mountains in Los Angeles County, east to the western foothills of the San Bernardino Mountains (San Bernardino County), and south through southern Orange and western Riverside Counties to central coastal San Diego County, California (CDFW 2013).

Thread-leaved brodiaea is known from 20 occurrences on Conserved Lands in MU6 (Black Mountain Open Space Park, Buena Vista Creek Ecological Reserve, Carlsbad Highlands Ecological Reserve, Carlsbad Oaks North Habitat Conservation Area, Lake Calavera Municipal Mitigation Parcel, Letter Box Canyon-Fox Miller Brodiaea Preserve, Rancho La Costa Habitat Conservation Area) and MU8 (Cleveland National Forest). There are 3 very large conserved populations (>10,000 individuals) of thread-leaved brodiaea, 4 large populations (>1,000 individuals), and 13 small populations (see online map: <http://arcg.is/2iBDr6m>).

### **Management Rationale**

This endemic species should be managed as a Species Management Focus Category SS Species due to its limited distribution in cismontane southwestern California. Populations in north coastal San Diego County are threatened by invasive plants, requiring management to ensure the species persistence in the MSPA. Threats to conserved populations of thread-leaved brodiaea include invasive nonnative annual plants, herbivory, recreational trampling, altered hydrology, loss of connectivity, and urban edge effects. Reduction in pollinator function from habitat loss and fragmentation could reduce sexual reproduction and affect genetic diversity.

## Monitoring and Management Approach

The overarching goal for thread-leaved brodiaea is to maintain or enhance existing occurrences to ensure multiple conserved occurrences with self-sustaining populations to increase resilience to environmental and demographic stochasticity, maintain genetic diversity, and ensure persistence over the long term (>100 years) in chaparral vegetation communities.

For the 2017–2021 planning cycle, the management and monitoring approach for thread-leaved brodiaea is to:

- (1) Inspect conserved occurrences every 2 years starting in 2017 to document abundance, record threats, and identify needed management actions.
- (2) Implement routine management as determined during monitoring.
- (3) Continue field research to develop habitat suitability and climate change models for thread-leaved brodiaea and other edaphic endemic plants to better understand habitat requirements and to identify and prioritize geographic areas important for connectivity and restoration.
- (4) Survey historical thread-leaved brodiaea locations to determine occurrence status; delineate potentially suitable habitat for new occurrences; identify the potential for enhancement and expansion; and collect data on occurrence status, habitat, threats, and management needs.
- (5) Use occurrence status and threat data to develop a section for thread-leaved brodiaea in the MSP Rare Plant Management Plan that prioritizes management actions.
- (6) Initiate preparation of a section for thread-leaved brodiaea in the MSP Seed Collection, Banking, and Bulking Plan that directs seed collection in the MSPA to ensure representation of different occurrences in the seed bank, provide propagules to preserve genetic diversity, support habitat restoration, and rescue occurrences in case of catastrophic disturbance.
- (7) Implement the highest-priority management actions.
- (8) Initiate seed collection and banking.

For details and the most up-to-date goals, objectives, and actions, go to the MSP Portal Thread-leaved Brodiaea summary page: [http://portal.sdmmp.com/view\\_species.php?taxaid=42806](http://portal.sdmmp.com/view_species.php?taxaid=42806)

### **Thread-leaved Brodiaea References**

CDFW. (California Department of Fish and Wildlife). 2013. California Natural Diversity Database. <https://www.wildlife.ca.gov/Data/CNDDDB/Maps-and-Data>. Accessed September 2016.

USFWS (U.S. Fish and Wildlife Service). 2009. "Brodiaea filifolia (thread-leaved brodiaea) 5-Year Review Summary and Evaluation U. S. Fish and Wildlife Service". Carlsbad, California.

## 1.9 Orcutt's Brodiaea (*Brodiaea orcuttii*) – Category SO

### Management Units with Known Occurrences

Orcutt's brodiaea is known from San Bernardino, Orange, and Riverside Counties south to San Diego County and Baja California, Mexico (Reiser 2001). The species' preferred habitat consists of vernal moist grasslands, mima mound topography, and the periphery of vernal pools. It is occasionally found growing on streamside embankments. Orcutt's brodiaea grows in soils of old terraces and alluvial fans, which are characterized as gravelly with or without a hardpan (Niehaus 1971). On Otay Mesa, soils include Stockpen gravelly loam, and on Mira Mesa, spoils include Redding gravelly loam (Reiser 2001). At vernal pool locations, Orcutt's brodiaea usually grows in swales leading into more developed pools and on the lower flanks of small mima mounds.

Within the MSPA, there are 7 large ( $\geq 1,000$  plants since 2010) occurrences, 11 small occurrences ( $< 1,000$  plants since 2010), and 5 occurrences of unknown size (see Table of Occurrences or online map: <http://arcg.is/2kFIdjS>). The large occurrences are on MU2 (General Dynamics East); MU4 (Simon Preserve, Elliot Preserve); and MU6 (Carroll Canyon Vernal Pool Preserve, Daley Ranch, Del Mar Mesa, Lopez Ridge). The small occurrences are on MU2 (Nobel Drive); MU3 (Otay Mountain, Otay Ranch Preserve, Copper Canyon); MU4 (Boulder Oaks Preserve, Oak Creek); MU6 (Escondido Creek Preserve, Rancho La Costa, Santa Fe Valley); and MU8 (Mount Olympus Preserve). The occurrences of unknown size are found on MU3 (Cedar Canyon, North San Ysidro Parcel); MU4 (North and West of El Capitan Reservoir on the Cleveland National Forest); and MU7 (Water's End).

### Management Categorization Rationale

Orcutt's brodiaea should be managed as a Species Management Focus Category SO Species due to a moderate risk of loss of significant occurrences from Conserved Lands in the MSPA and because managing vegetation alone will not ensure persistence of the species (see Vol. 1, Table 2-4). Factors contributing to status include susceptibility to disturbance from invasive species, small populations fragmented by urbanization, and endemism.

The most serious threats to Orcutt's brodiaea are from development, foot traffic, grazing, nonnative plants, military activities, vehicles, road construction, road

maintenance, and dumping (CNPS 2016). Orcutt's brodiaea is also threatened by competition from nonnative plant taxa in areas where soil disturbance favors European species of plants (County of Riverside 2003).

### **Management and Monitoring Approach**

The overarching goal for Orcutt's brodiaea is to maintain or enhance existing occurrences to ensure multiple conserved occurrences with self-sustaining populations to increase resilience to environmental and demographic stochasticity, maintain genetic diversity, and ensure persistence over the long term (>100 years) in grasslands and vernal pool vegetation communities.

For the 2017–2021 planning cycle, the management and monitoring approach is to:

- (1) Inspect Orcutt's brodiaea occurrences annually on Conserved Lands (see Table of Occurrences) using the regional rare plant IMG monitoring protocol to record abundance and collect habitat and threats covariate data to determine management needs. Conduct routine management actions identified. Depending on the type and level of threat, management should be conducted as needed, not necessarily every year, and using BMPs with precautions to do no harm.
- (2) Survey historical Orcutt's brodiaea locations to determine occurrence status; survey and delineate potentially suitable habitat for new occurrences; survey existing occurrences to identify the potential for enhancement and expansion; and at all sites collect data on occurrence status, habitat, and threats. Determine management needs.
- (3) Establish 2 new Orcutt's brodiaea occurrences at Proctor Valley and Cal Terraces/Dennery Canyon. Invasive plant control should be conducted using BMPs so that invasive plants are reduced to  $\leq 20\%$  absolute cover within the occurrence's occupied extent and adjacent suitable habitat.
- (4) Prepare an Orcutt's brodiaea section in the MSP Seed Collection, Banking, and Bulking Plan to preserve genetic diversity and rescue occurrences in case of catastrophic disturbance. The plan should include recommendations for collecting and storing seeds for conservation banking; management-oriented research; rescuing occurrences after catastrophic disturbances;

and seed bulking and outplanting to augment extant occurrences or to establish new occurrences with consideration of genetic implications for population sustainability.

- (5) Collect Orcutt's brodiaea seed for conservation banking and bulk seed for establishment of new occurrences at Cal Terraces/Dennery Canyon and Proctor Valley. Begin implementing high-priority actions for Orcutt's brodiaea in the MSP Seed Collection, Banking, and Bulking Plan to collect and store seeds at a permanent seed bank and to provide propagules as needed for management-oriented research, existing population enhancement, and establishment of new occurrences.
- (6) Begin preparing an Orcutt's brodiaea section in the MSP Rare Plant Management Plan to maintain large occurrences and expand  $\geq 3$  small occurrences on Conserved Lands (see Table of Occurrences) based upon an assessment of data on occurrence status, habitat, and threats. Minimum criteria for enhancement are to reduce invasive annual nonnative plants and thatch to  $\leq 20\%$  absolute cover within the occurrence's maximum occupied extent and a surrounding buffer area equal to 25% of this extent. Include recommendations from the MSP Seed Collection, Banking, and Bulking Plan; relevant BMPs; and for monitoring the effectiveness of management actions. Begin implementing highest-priority management actions identified for Orcutt's brodiaea in the MSP Rare Plant Management Plan and monitor effectiveness of implementation.

For details and the most up-to-date goals, objectives, and actions, go to the MSP Portal Orcutt's Brodiaea summary page:  
[https://portal.sdmmp.com/view\\_species.php?taxaid=42815](https://portal.sdmmp.com/view_species.php?taxaid=42815)

### **Orcutt's Brodiaea References**

CNPS (California Native Plant Society). 2016. *Inventory of Rare and Endangered Plants* (Online Edition, v8-02). California Native Plant Society.  
<http://www.rareplants.cnps.org>.

County of Riverside. 2003. *Western Riverside County Multiple Species Habitat Conservation Plan (MSHCP). Volume II- Section A MSHCP Conservation Area Description. Prepared for: County Of Riverside Transportation and Land Management Agency.* Prepared by: Dudek & Associates.



Niehaus, T. F. 1971. A Biosystematic Study of the Genus *Brodiaea* (Amaryllidaceae).  
*U.C. Publications in Botany* 60(1):1–66.

Reiser, C. H. 2001. *Rare Plants of San Diego County*. San Diego, CA: Aquifer Press.

## **1.10 Santa Rosa Brodiaea (*Brodiaea santarosae*) – Category SS**

### **Management Units with Known Occurrences**

Santa Rosa brodiaea is a perennial monocot herb endemic to the Santa Ana Mountains in northern San Diego and southwestern Riverside Counties (Chester et al. 2007). It has a very small range and is restricted to soils on or very close to the Santa Rosa Basalt, which is estimated to be 6.5 to 10 million years old (Hull and Nicholson 1992). It can occupy various habitat types, including areas next to vernal pools, but it can also be found in drier locations. Santa Rosa brodiaea can grow in disturbed areas, disturbed soils, on top of the water pipes, and in roadside berms.

In the MSPA, it is known from 3 occurrences on Conserved Lands in MU8 on the Cleveland National Forest, all in the vicinity of Miller Mountain or Margarita Peak (see Table of Occurrences and online map: <http://arcg.is/2iBDW0e>).

### **Management Categorization Rationale**

Santa Rosa brodiaea should be managed as a Species Management Focus Category SS Species due to a moderate risk of loss from Conserved Lands in the MSPA and because managing vegetation alone will not ensure its persistence (see Vol. 1, Table 2-4). Santa Rosa brodiaea is at moderate risk of loss from the MSPA because of its extremely restricted distribution with only 3 occurrences at 2 sites and limited habitat with Santa Rosa basalt soils (see Vol. 3, App.1, Species Profiles). This species primarily occurs in the San Mateo Wilderness (administered by Cleveland National Forest) and the potential for impacts is low, except for fire. This species is also reported from disturbed sites in areas closer to development indicating it has some tolerance for disturbance (Chester et al. 2007).

More research is needed on the characterized threats for this species. Because it does not appear to face a high degree of immediate threat given its remote location in a wilderness area, it is not categorized as an SL or SO species.

### **Management and Monitoring Approach**

The overarching goal for Santa Rosa brodiaea is to maintain existing occurrences to ensure multiple conserved occurrences with self-sustaining populations to increase resilience to environmental and demographic stochasticity, maintain genetic

diversity, and improve chances of persistence over the long term (>100 years) in grassland and vernal pool/alkali playa habitats.

For the planning cycle of 2017–2021, the management and monitoring approach is to inspect extant Santa Rosa brodiaea occurrences on Conserved Lands (see Table of Occurrences) using the regional rare plant IMG monitoring protocol to record abundance and collect habitat and threats covariate data to determine management needs. Conduct routine management actions as identified through the IMG monitoring. Depending on the type and level of threat, management should be conducted as needed, not necessarily every year, and using BMPs with precautions to do no harm.

For details and the most up-to-date goals, objectives, and actions, go to the MSP Portal Santa Rosa Brodiaea summary page: [https://portal.sdmmp.com/view\\_species.php?taxaid=810190](https://portal.sdmmp.com/view_species.php?taxaid=810190).

### **Santa Rosa Brodiaea References**

- Chester, T., W. Armstrong, and K. Madore. 2007. *Brodiaea santarosae* (Themidaceae), A New Rare Species from the Santa Rosa Basalt Area of the Santa Ana Mountains of Southern California. *Madrono* 54(2):187–198. [https://doi.org/10.3120/0024-9637\(2007\)54\[187:bstanr\]2.0.co;2](https://doi.org/10.3120/0024-9637(2007)54[187:bstanr]2.0.co;2).
- Hull, A., and C. Nicholson. 1992. Seismotectonics of the Northern Elsinore Fault Zone, Southern California. *Bulletin of the Seismological Society of America* 82(2):800–818. April 1992.

### **1.11 Salt Marsh Bird's-Beak (*Chloropyron maritimum* ssp. *maritimum*) – Category SL**

#### **Management Units with Known Occurrences**

Salt marsh bird's-beak is a hemiparasitic annual plant found in the upper tidal zones of coastal salt marshes in central and southern California and northern Baja California, Mexico (USFWS 2009). Three life history characteristics affect the distribution: (1) annual habit, (2) hemiparasitic mode of nutrition, and (3) the fact that it is a halophyte (a salt-tolerant plant). Within a given marsh, the distribution of salt marsh bird's beak depends upon the local dispersal of its seeds, the distribution of potential host plants, and the annual environmental conditions. It typically grows with species of *Salicornia*, *Distichlis*, *Frankenia*, *Suaeda*, and *Atriplex* in the higher areas (Purer 1942). Salt marsh bird's beak generally grows in areas of low rainfall and high evaporation rates, with little or no summer rainfall and highly seasonal stream flows (Zedler et al. 1986).

Conserved Lands in the MSPA support 7 occurrences of salt marsh bird's-beak (see Table of Occurrences). There are 6 large ( $\geq 1,000$  plants) occurrences in MU1: Tijuana Estuary (3 occurrences), Sweetwater Marsh (2 occurrences), and Dog Beach (MSP-MOM 2014). There are 4 small ( $< 1,000$  plants) in MU1 at the Tijuana Estuary, Tijuana Slough, San Diego Bay, and Camp Surf. There is also 1 occurrence of unknown size at the Tijuana Estuary (see online map: <http://arccg.is/2iBC8oe>).

#### **Management Categorization Rationale**

Salt marsh bird's-beak should be managed as a Species Management Focus Category SL Species due to a moderate risk of loss from Conserved Lands in the MSPA and because managing salt marsh vegetation alone will not ensure persistence of the species (see Vol. 1, Table 2-4). This species faces a moderate risk of loss due to its restricted distribution to salt marshes in only MU1 in coastal south San Diego County. It is also vulnerable because of high risk of threats and an annual, hemiparasitic life cycle (see Vol. 3, App. 1, Species Profiles).

Salt marsh bird's-beak faces a multitude of threats. Small and isolated occurrences are already showing low genetic diversity, with the loss of rare alleles as a result of genetic drift leading to potential reductions in fitness (Helenurm and Parsons 1997; USFWS 2009). Small occurrences restricted to limited upper tidal marsh habitat are also vulnerable to extirpation from stochastic events and catastrophic disturbances.

Invasive nonnative plants, particularly curved hard grass (*Parapholis incurva*) and annual beard grass (*Polypogon monspeliensis*), affect growth and productivity of salt marsh bird's-beak occurrences (Fellows and Zedler 2005). Other factors affecting plant growth and reproductive potential include drought and seed herbivory by the salt marsh snout moth (*Lipographis fenestrella*; Parsons and Zedler 1997). Ongoing altered hydrology and sediment dynamics associated with urbanization are converting intertidal salt marshes to upland habitats decreasing the habitat available to salt marsh bird's-beak (Callaway and Zedler 2004; Zedler and West 2008). The species' life history as a semiparasitic annual plant increases the risk of occurrence loss (USFWS 2009). Off-highway vehicle activities threaten the southernmost occurrences, although this threat has been reduced by implementation of specific management measures.

Climate change is expected to eliminate some suitable habitat through inundation with rising sea levels (USFWS 2009). At more protected sites, tidal surges are expected to increase soil salinity, which in combination with more frequent, prolonged and intensive droughts could produce conditions limiting salt marsh bird's-beak growth and reproduction.

### **Management and Monitoring Approach**

The overarching goal for salt marsh bird's beak is to maintain or enhance existing occurrences and create salt marsh to establish new occurrences to reduce risk of population loss to rising sea levels and to ensure multiple conserved occurrences with self-sustaining populations to increase resilience to environmental and demographic stochasticity, maintain genetic diversity, and ensure persistence over the long term (>100 years) in salt marsh vegetation communities.

For the planning cycle of 2017–2021, the management and monitoring approach is to:

- (1) Annually inspect salt marsh bird's-beak occurrences on Conserved Lands (see Table of Occurrences) using the regional rare plant IMG monitoring protocol to record abundance and collect habitat and threats covariate data to determine management needs and conduct routine management actions as identified.

- (2) Complete the study begun in 2016 to characterize the population genetic structure, gene flow, and genetic diversity for salt marsh bird's-beak occurrences (see Table of Occurrences).
- (3) Develop models predicting habitat suitability under future climate scenarios and combine the habitat models with projected increases in sea level and urban development to evaluate and prioritize sites for establishing new occurrences of salt marsh bird's-beak.
- (4) Prepare a salt marsh bird's-beak section in the MSP Rare Plant Management Plan that prioritizes management actions to maintain and enhance large occurrences, enhance and expand  $\geq 3$  small occurrences, and establish  $\geq 1$  new occurrence on Conserved Lands (see Table of Occurrences). Begin implementing high-priority actions for salt marsh bird's-beak from the MSP Seed Collection, Banking, and Bulking Plan to collect and store seeds at a permanent seed bank and to provide propagules as needed for management-oriented research, existing population enhancement, and establishment of new occurrences. Collect salt marsh bird's-beak seed for conservation banking.
- (5) Prepare a salt marsh bird's-beak section in the MSP Seed Collection, Banking, and Bulking Plan that incorporates best science and management practices (Royal Botanic Gardens, Kew 2001; Wall 2009) to preserve genetic diversity and rescue occurrences in case of catastrophic disturbance. Begin implementing highest-priority management actions identified for salt marsh bird's-beak in the MSP Rare Plant Management Plan and monitor effectiveness of implementation.

For details and the most up-to-date goals, objectives, and actions, go to the MSP Portal Salt Marsh Bird's-Beak summary page: [https://portal.sdmmp.com/view\\_species.php?taxaid=834234](https://portal.sdmmp.com/view_species.php?taxaid=834234).

### **Salt Marsh Bird's Beak References**

Callaway, John C., and Joy B. Zedler. 2004. Restoration of Urban Salt Marshes: Lessons from Southern California. *Urban Ecosystems* 7:107–24. DOI:10.1023/B:UECO.0000036268.84546.53.

- Fellows, M.Q.N., and J. B. Zedler. 2005. Effects of the Non-Native Grass, *Parapholis Incurva* (Poaceae), on the Rare and Endangered Hemiparasite, *Cordylanthus Maritimus* Subsp. *Maritimus* (Scrophulariaceae). *Madroño* 52(2):91–98. DOI:10.3120/0024-9637(2005)52[91:EOTNGP]2.0.CO;2.
- Helenurm, K., and L. S. Parsons. 1997. Genetic Variation and the Reintroduction of *Cordylanthus maritimus* ssp. *maritimus* to Sweetwater Marsh, California. *Restoration Ecology* 5 (3): 236–244.
- MSP-MOM. 2014. *Management Strategic Plan Master Occurrence Matrix*.
- Parsons, L. S., and J. B. Zedler. 1997. Factors Affecting the Reestablishment of an Endangered Annual Plant at a California Salt Marsh. *Ecological Applications* 7(1):253–267.
- Purer, E. 1942. Plant Ecology of the Coastal Salt Marshlands of San Diego County, California. *Ecological Monographs* 12(1):81–111.
- Royal Botanic Gardens, Kew. 2001. *Field Manual for Seed Collectors: Seed Collecting for the Millennium Seed Bank Project*, Royal Botanic Gardens, Kew.
- USFWS (U.S. Fish and Wildlife Service). 2009. *Chloropyron Maritimum Subsp. Maritimum (Cordylanthus Maritimus Subsp. Maritimus) (Salt Marsh Bird's-Beak) 5-Year Review: Summary and Evaluation*. Carlsbad, California.
- Wall, M. 2009. *Seed Collection Guidelines for California Native Plant Species*. Prepared for Rancho Santa Ana Botanic Garden.
- Zedler, J.B, J. Covin, C. Nordby, P. Williams, and J. Boland. 1986. Catastrophic Events Reveal the Dynamic Nature of Salt-Marsh Vegetation in Southern California. *Estuaries* 91(1):75–80.
- Zedler, J. B., and J. M. West. 2008. Declining Diversity in Natural and Restored Salt Marshes: A 30-Year Study of Tijuana Estuary. *Restoration Ecology* 16(2):249–62. DOI:10.1111/j.1526-100X.2007.00268.x.

## **1.12 Orcutt's Spineflower (*Chorizanthe orcuttiana*) – Category SL**

### **Management Units with Known Occurrences**

Orcutt's spineflower occurs in sandy openings within 5 kilometers of the coast in maritime chaparral and Diegan coastal sage scrub plant communities in San Diego County (Bauder 2000; Lawson 2011). Within the MSPA on Conserved Lands, there are 2 occurrences of Orcutt's spineflower in MU7 and 2 known occurrences in MU6, with 1 potentially extant occurrence (see Table of Occurrences). The MU7 occurrence is small (<500 individuals) and is located at Torrey Pines State Reserve along Gully Trail. In MU6, 6 plants were last detected in 2005 at Oak Crest Park in Encinitas (Bauder and Sakrison 2010; Bauder, Sakrison, and Truesdale 2010) though none were detected in 2009. In 2015, surveys were performed in Sorrento Hills, Gonzales Canyon, and Crest Canyon (D. Hogan, pers. comm.). There were 125 plants detected in Sorrento Hills and 1,200 plants detected in Gonzales Canyon. The population is unknown in Crest Canyon. Orcutt's spineflower has long-lived seeds (Bauder, Sakrison, and Snapp-Cook 2010) so there may be a viable seed bank remaining in the soil that could result in reemergence of the Oakcrest Park occurrence under suitable growing conditions (T. Oberbauer, pers. comm.). Historically, Orcutt's spineflower was found at a second location at Torrey Pines State Reserve, but it has not been seen there since 1987 (Bauder 2000; USFWS 2007). Outside the MSPA, there are 3 locations of Orcutt's spineflower on Point Loma at the U.S. Naval Base (Bauder and Sakrison 2010; Bauder, Sakrison, and Truesdale 2010).

### **Management Categorization Rationale**

Orcutt's spineflower should be managed as a Species Management Focus Category SL Species due to a high risk of loss from Conserved Lands in the MSPA and because managing the general vegetation community alone will not ensure persistence of the species (see Vol. 1, Table 2-4). This species' entire range is within San Diego County and there is limited suitable habitat remaining. Only 1 small known occurrence and 1 potentially extant occurrence are found on Conserved Lands in the MSPA. The species is vulnerable due to its annual life cycle, low genetic diversity, and high risk of threats.

Threats to Orcutt's spineflower include invasive nonnative plants, an altered fire regime, overgrown native vegetation, irrigation runoff, and trampling (Bauder 2000; USFWS 2007; Bauder and Sakrison 2010; Bauder, Sakrison, and Truesdale



2010). A genetic study of the Point Loma occurrences found that there is fine-scale genetic heterogeneity within and among patches, while large-scale genetic variability is low (Bauder, Sakrison, and Truesdale 2010). The results indicate there is little gene flow among patches, and selfing rather than outcrossing is the dominant form of reproduction. Small, isolated occurrences with low genetic diversity are particularly vulnerable to inbreeding and extirpation from stochastic events and catastrophic disturbances.

### **Management and Monitoring Approach**

The overarching goal for Orcutt's spineflower is to maintain or enhance existing occurrences and reestablish historical occurrences, as needed, to ensure multiple conserved occurrences with self-sustaining populations to increase resilience to environmental and demographic stochasticity, maintain genetic diversity, and ensure persistence over the long term (>100 years) in coastal bluff and coastal sage scrub communities.

Extensive studies and habitat management have been conducted at the 3 Orcutt's spineflower occurrences on U.S. Naval lands at Point Loma (Bauder 2000; Bauder and Sakrison 2010; Bauder, Sakrison, and Truesdale 2010), which can be used as a model for managing other occurrences with similar conditions on Conserved Lands. The Point Loma occurrences were limited in distribution and abundance by invasive nonnative ice plant (*Carpobrotus* spp.) and *Acacia* spp. shrubs. These 3 occurrences are in fairly close proximity and thought to represent one large historically contiguous occurrence (USFWS 2007). The occurrences expanded with the removal of these plants and the underlying duff (Bauder and Sakrison 2010; Bauder, Sakrison, and Truesdale 2010). Because Orcutt's spineflower seeds are believed to be long lived in soil seed banks, it is likely that the removal of nonnative ice plant and *Acacia* spp. shrubs in unoccupied suitable habitat resulted in germination of seeds remaining in the soil (Bauder, Sakrison, and Truesdale 2010). The U.S. Navy has begun collecting Orcutt's spineflower seed and storing it at Rancho Santa Ana Botanic Gardens following the Rancho Santa Ana Botanic Gardens seed collection guidelines (Wall 2009).

For the 2017–2021 planning cycle, the management and monitoring approach for Orcutt's spineflower is to:

- (1) Conduct annual surveys of all Orcutt's spineflower occurrences on conserved lands (see Table of Occurrences) using the regional rare plant

IMG monitoring protocol to determine current status and collect covariate habitat and threats data to assess management needs.

- (2) Conduct routine management actions as identified through the IMG monitoring at Orcutt's spineflower occurrences on Conserved Lands (see Table of Occurrences). Depending on the type and level of threat, management should only be conducted as needed, not necessarily every year, and using BMPs with precautions to do no harm.
- (3) Continue efforts begun in 2015 to survey historical Orcutt's spineflower locations to determine current occurrence status; survey and delineate potentially suitable habitat for new occurrences; survey existing occurrences to identify the potential for enhancement and expansion; and at all sites collect data on occurrence status, habitat, and threats and determine management needs.
- (4) Continue BMPs initiated in 2015 to establish 4 new occurrences of Orcutt's spineflower at sites in MUs 6 and/or 7 and maintain these occurrences through at least 2018.
- (5) Prepare a section for Orcutt's spineflower in the MSP Seed Collection, Banking, and Bulking Plan to preserve genetic diversity and rescue occurrences in case of catastrophic disturbance. The plan should incorporate best science and management practices (Wall 2009; Royal Botanic Gardens, Kew 2016) and recommendations from the 2014 genetic study to provide guidance for collecting and storing seeds over the long term at a permanent, established conservation seed bank (e.g., Institute for Conservation Research Native Plant Seed Bank, Rancho Santa Ana Botanic Garden Seed Conservation Program) and for providing a source of seeds for management purposes. The plan should include recommendations for collecting and storing seeds for conservation banking; management-oriented research; rescuing occurrences after catastrophic disturbances; and seed bulking and outplanting to augment extant occurrences or to establish new occurrences with consideration of genetic implications for population sustainability. Begin implementing high-priority actions for Orcutt's spineflower in the MSP Seed Collection, Banking, and Bulking Plan to collect and store seeds at a permanent seed bank and to provide propagules as needed for management-oriented research, existing population enhancement, and establishment of new occurrences.

- (6) Prepare a section for Orcutt's spineflower in the MSP Rare Plant Management Plan to maintain large occurrences (>1,000 plants) and expand  $\geq 3$  small occurrences on Conserved Lands (see Table of Occurrences) based upon an assessment of data on occurrence status, habitat, and threats. Minimum criteria for enhancement are to reduce invasive annual nonnative plants and thatch to  $\leq 20\%$  absolute cover within the occurrence's maximum occupied extent and a surrounding buffer area equal to 25% of this extent. Include recommendations from the MSP Seed Collection, Banking, and Bulking Plan, relevant BMPs, and for monitoring the effectiveness of management actions. Begin implementation of the highest-priority management actions for Orcutt's spineflower identified in the MSP Rare Plant Management Plan, and monitor the effectiveness of implementation.

For details and the most up-to-date goals, objectives, and actions, go to the MSP Portal Orcutt's Spineflower summary page:  
[https://portal.sdmmp.com/view\\_species.php?taxaid=21019](https://portal.sdmmp.com/view_species.php?taxaid=21019)

### **Orcutt's Spineflower References**

- Bauder, E. T., and J. Sakrison. 2010. *Chorizanthe orcuttiana* (Orcutt's spineflower) Final Report (2010). Unpublished report prepared for Department of the Navy (Naval Facilities Engineering Command, Southwest) (contract #s N68711-04-LT-A0058; N68711-05-LTA0051).
- Bauder, E. T., J. Sakrison, and J. Snapp-Cook. 2010. *Chorizanthe orcuttiana* (Orcutt's spineflower) Final Report (2010). Unpublished report prepared for Department of the Navy (Naval Facilities Engineering Command, Southwest) (contract # N68711-98-LT88010).
- Bauder, E. T., J. Sakrison, and H. D. Truesdale. 2010. *Chorizanthe orcuttiana* (Orcutt's spineflower) Final Report (2010). Unpublished report prepared for Department of the Navy (Naval Facilities Engineering Command, Southwest) (contract # N68711-02-LT00041).
- Bauder, Ellen. 2000. Recovery and Management of Orcutt's Spineflower (*Chorizanthe orcuttiana*) Final Report. Prepared for the California Department of Fish and Game.

- Hogan, D. 2015. Email to Kris Preston on 5-8-15 reporting new populations of Orcutt's spineflower found during April 2015 surveys with link to KPBS radio feature on the survey results.
- Lawson, D. M. 2011. Multi-species conservation in the context of global change. Unpublished Doctoral Dissertation submitted to University of California, Davis and San Diego State University. 132 pp.
- Royal Botanic Gardens, Kew. 2001. *Field Manual for Seed Collectors: Seed Collecting for the Millennium Seed Bank Project*, Royal Botanic Gardens, Kew.
- USFWS (U.S. Fish and Wildlife Service). 2007. *Chorizanthe orcuttiana* (Orcutt's spineflower) *Five Year Review: Summary and Evaluation*. Prepared by the U.S. Fish and Wildlife Service Carlsbad Fish and Wildlife Office.
- Wall, Michael. 2009. *Seed Collection Guidelines for California Native Plant Species*. Prepared for Rancho Santa Ana Botanic Garden.

### **1.13 San Miguel Savory (*Clinopodium chandleri*) – Category SL**

#### **Management Units with Known Occurrences**

San Miguel savory is a small perennial herb occurring on gabbroic and metavolcanic soils in chaparral and oak woodlands in southern California and northern Baja California, Mexico (Reiser 1994). In San Diego County, San Miguel savory is found on chamise-dominated slopes on Los Posas stony fine sandy loams or San Miguel Exchequer rocky silt loam soils.

Within the MSPA, there are 2 extant occurrences of San Miguel savory on Conserved Lands (see Table of Occurrences or online map: <http://arcg.is/2kFD8bw>). In MU3, San Miguel Mountain supports 4 locations within relative proximity that are considered a single small occurrence (<500 individuals). There is a second small occurrence in MU4 at Boulder Oaks Preserve. Old records of San Miguel savory ( $\leq 1990$ ) are from McGinty Peak, the Jamul Mountains, and Otay Mountain in MU3; from the Barona Padre Creek area in MU4; and from Sandia Creek in MU8 (City of San Diego et al. 1998; CDFW 2012). Occurrences at Jamul Mountains, Otay Mountain, and Padre Baron Creek have burned at least once in the last decade and their current status is unknown. San Miguel savory was not detected at McGinty Mountain during focused surveys in 2000 (County of San Diego 2007). This plant grows in the understory of chaparral and can be difficult to detect.

#### **Management Categorization Rationale**

San Miguel savory should be managed as a Species Management Focus Category SL Species due to a moderate risk of loss from Conserved Lands in the MSPA and because managing chaparral and oak woodland vegetation alone will not ensure its persistence (see Vol. 1, Table 2-4). San Miguel savory is at moderate risk of loss from the MSPA, as it is a perennial herb with only 2 small (<500 individuals) occurrences on Conserved Lands (see Vol. 3, App. 1, Species Profiles). The two small, isolated conserved occurrences are vulnerable to loss of genetic diversity and extirpation due to environmental or demographic stochasticity and catastrophic disturbance, such as fire. The species is also threatened by agricultural conversion, urban development, and recreational activities (CNPS 2014).

## Management and Monitoring Approach

The overarching goal for San Miguel savory is to maintain or enhance existing occurrences to ensure multiple conserved occurrences with self-sustaining populations to increase resilience to environmental and demographic stochasticity, maintain genetic diversity, and improve chances of persistence over the long term (>100 years) in chaparral, coastal sage scrub, and oak woodland vegetation communities.

For the 2017–2021 planning cycle, the management and monitoring approach is to:

- (1) Inspect San Miguel savory occurrences on Conserved Lands (see Table of Occurrences) using the regional rare plant IMG monitoring protocol to record abundance and collect habitat and threats covariate data to determine management needs. Repeat monitoring every 2 years.

Conduct routine management actions as identified through the IMG monitoring. Depending on the type and level of threat, management should be conducted as needed, not necessarily every year, and using BMPs with precautions to do no harm.

- (2) Prepare a San Miguel savory section in the MSP Seed Collection, Banking, and Bulking Plan that incorporates best science and management practices (Wall 2009; Royal Botanic Gardens, Kew 2016) to preserve genetic diversity and rescue occurrences in case of catastrophic disturbance. Begin implementing high-priority actions for San Miguel savory in the MSP Seed Collection, Banking, and Bulking Plan to collect and store seeds at a permanent seed bank and to provide propagules as needed for management-oriented research, existing population enhancement, and establishment of new occurrences
- (3) Prepare a San Miguel savory section in the MSP Rare Plant Management Plan that prioritizes management actions to enhance occurrences on Conserved Lands (see Table of Occurrences) based upon an assessment of data on occurrence status, habitat, and threats. Begin implementing highest-priority management actions identified for San Miguel savory in the MSP Rare Plant Management Plan and monitor effectiveness of implementation.

For details and the most up-to-date goals, objectives, and actions, go to the MSP Portal San Miguel Savory summary page: [https://portal.sdmmp.com/view\\_species.php?taxaid=565077](https://portal.sdmmp.com/view_species.php?taxaid=565077).

### **San Miguel Savory References**

CDFW (California Department of Fish and Wildlife). 2012. California Natural Diversity Database. Species occurrences shapefile, accessed 2012 and 2013.

City of San Diego. 1998. Final Multiple Species Conservation Program: MSCP Plan.

CNPS (California Native Plant Society). 2014. CNPS Rare Plant Program *Inventory of Rare and Endangered Plants* (Online Edition, v8-02, <http://www.rareplants.cnps.org/>). Sacramento, CA.

County of San Diego. 2007. *County of San Diego MSCP Monitoring Summary Report January 1998 – June 2007*. Prepared for USFWS and CDF&G.

Reiser, C. H. 1994. *Rare Plants of San Diego County*. Imperial Beach, CA.

Royal Botanic Gardens, Kew. 2001. *Field Manual for Seed Collectors: Seed Collecting for the Millennium Seed Bank Project*, Royal Botanic Gardens, Kew.

Wall, Michael. 2009. Seed Collection Guidelines for California Native Plant Species. Prepared for Rancho Santa Ana Botanic Garden.

## **1.14 Otay Tarplant (*Deinandra conjugens*) – Category SS**

### **Management Units with Known Occurrences**

Otay tarplant is restricted in distribution to clay soils in grasslands and open coastal sage scrub in southwest San Diego County and northwest Baja California, Mexico (Reiser 1994). There are 28 occurrences on Conserved Lands in MU3 (see Table of Occurrences) and a single small isolated occurrence in Paradise Valley in MU2, though this occurrence is not prioritized in an IMA. Large occurrences (>5,000 individuals) are found at Bonita Meadows, Trimark, Johnson Canyon, west of Moody Canyon, Proctor Valley, Rolling Hills Ranch, north side of Otay River Valley, Mother Miguel grasslands, Dennery Canyon, Rice Canyon, and the Rancho Jamul Ecological Reserve.

### **Management Categorization Rationale**

Otay tarplant is warranted for designation as a Species Management Focus Category SS Species due to a moderate risk of loss of significant occurrences from Conserved Lands in the MSPA (see Vol. 1, Table 2-4). Factors contributing to this risk of loss include a limited range in southwestern San Diego County and northwestern Baja California, restricted distribution in the MSPA with occurrences in only 2 MUs, an annual life cycle, self-incompatibility in reproduction, and a high level of threats. This management categorization is further supported by ongoing regional management of Otay tarplant as part of the South County Grasslands project (CBI 2012). For these reasons, Otay tarplant is important to manage with a species-specific focus; however, because it has many large, conserved occurrences it is designated an SS rather than SO species.

The primary threat to Otay tarplant occurrences is invasive nonnative plants, especially annual grasses and forbs (USFWS 2009; IEMM 2012). Populations are also impacted by direct disturbance from off-highway vehicle activity; illegal trails; trampling; and maintenance of access roads, utility corridors, trails, and fuel modification zones. Otay tarplant is at risk of loss of genetic connectivity due to habitat fragmentation and a potential loss of pollinators.

### **Management and Monitoring Approach**

The overarching goal for Otay tarplant is to maintain or enhance occurrences and establish historic occurrences, as needed, to ensure multiple conserved occurrences



with self-sustaining populations to increase resilience to environmental and demographic stochasticity, maintain genetic diversity, and ensure persistence over the long term (>100 years) in grassland and coastal sage scrub communities.

The following goals and objectives for Otay tarplant are based upon those developed by the South County Grasslands Project (CBI 2012; Land IQ and CBI 2015) in order to integrate and ensure consistency in management efforts. Because this is a Category SS species, not all management actions identified below may be implemented within the planned time period if it is determined there is an urgent need to allocate scarce management resources to species at a higher risk of loss from the MSPA.

For the planning cycle of 2017–2021, the management and monitoring approach is to:

- (1) Conduct annual inspections of extant occurrences of Otay tarplant on Conserved Lands (see Table of Occurrences) using the regional rare plant IMG monitoring protocol to record spatial extent, estimate abundance, and collect habitat and threat covariate data to determine management needs.
- (2) Conduct routine management actions identified through the annual IMG monitoring at Otay tarplant occurrences on Conserved Lands. Depending on the type and level of threat, management should only be conducted as needed, not necessarily every year, and using BMPs with precautions to do no harm.
- (3) Continue the collaboration with the South County Grasslands Project initiated in 2014 to develop BMPs for landscape-scale restoration of Otay tarplant habitat in MU3 that includes testing methods of seeding and invasive plant control so that nonnative plants and thatch are reduced to <20% relative cover and thatch to <5 centimeters tall and native plants ≥25% relative cover. These percent cover criteria could be revised based on data collected from an acceptable reference site.
- (4) Continue a study begun in 2016 to characterize the population genetic structure, gene flow, and genetic diversity for Otay tarplant occurrences. The study will determine if there is evidence of mixed ploidy levels within or among occurrences; evaluate vulnerability of occurrences to genetic drift and loss of genetic diversity; assess the level of gene flow among

occurrences; identify if there are signatures of genetic bottlenecks or low genetic diversity in occurrences that have undergone recent reductions; and look for evidence of local population adaptation. Based on the results of the genetic analyses, management recommendations will include whether common garden and reciprocal transplantations are necessary before proceeding with population enhancement or restoration and will provide specific recommendations for collecting, bulking, and distributing seed to enhance existing occurrences or establish new occurrences.

- (5) Continuing for 3 years at the 3 Otoy tarplant restoration sites initiated under the South County Grasslands Project, use BMPs to maintain the maximum occupied extent and a surrounding buffer area equal to 25% of this extent by preventing ground disturbance and reducing nonnative plants and thatch to <20% total cover and thatch to <5 centimeters tall,
- (6) Begin preparing an Otoy tarplant section in the MSP Rare Plant Management Plan that prioritizes management actions to maintain and expand conserved occurrences based upon an assessment of data on occurrence status, habitat, and threats. Minimum criteria for enhancement are to reduce invasive annual nonnative plants and thatch to  $\leq 20\%$  absolute cover within the occurrence's maximum occupied extent and a surrounding buffer area equal to 25% of this extent. Include recommendations for Otoy tarplant from the MSP Seed Collection, Banking, and Bulking Plan, relevant BMPs, and for monitoring the effectiveness of management actions. Begin implementation of highest-priority management actions for Otoy tarplant identified in the MSP Rare Plant Management Plan and monitor effectiveness of implementation.
- (7) Prepare a section for Otoy tarplant in the MSP Seed Collection, Banking, and Bulking Plan to preserve genetic diversity and rescue occurrences in case of catastrophic disturbance. The plan should incorporate best science and management practices (e.g., Wall 2009; Royal Botanic Gardens, Kew 2016) and provide guidelines for collecting and storing seeds over the long term at a permanent, established conservation seed bank (e.g., Institute for Conservation Research Native Plant Seed Bank, Rancho Santa Ana Botanic Garden Seed Conservation Program) and for providing a source of seeds for management purposes. The plan should include recommendations for collecting and storing seeds for conservation banking; management-oriented research; rescuing occurrences after catastrophic disturbances;

and seed bulking and outplanting to augment extant occurrences or to establish new occurrences with consideration of genetic implications for population sustainability. Begin implementing the MSP Seed Collection, Banking, and Bulking Plan for Otay tarplant to collect and store seeds at a permanent seed bank and to provide propagules as needed for management-oriented research, existing population enhancement, and establishment of new occurrences.

- (8) Continue field research into soils and habitat relationships and development of habitat suitability and climate change models for Otay tarplant and other edaphic endemic plants to better understand habitat requirements and to identify and prioritize geographic areas important for connectivity, restoration, and range shifts due to climate change and other threats.

For details and the most up-to-date goals, objectives, and actions, go to the MSP Portal Otay Tarplant summary page:  
[https://portal.sdmmp.com/view\\_species.php?taxaid=780273](https://portal.sdmmp.com/view_species.php?taxaid=780273)

### Otay Tarplant References

CBI (Conservation Biology Institute). 2012. Draft Otay Tarplant Management Vision South County Grasslands Project.

IEMM (Institute for Ecological Monitoring and Management). 2012. A Conceptual Model for: Otay Tarplant (*Deinandra conjugens*). Prepared for The Nature Conservancy. 1/3/2012. San Diego State University.

Land IQ and CBI (Land IQ and Conservation Biology Institute). 2015. South County Grassland Project, Phase 2, 2015 Final Report. Prepared for SANDAG TransNet EMP Land Management Grant Program. June 2015.

Reiser, C. H. 1994. Rare Plants of San Diego County. Imperial Beach, CA.

Royal Botanic Gardens, Kew. 2001. *Field Manual for Seed Collectors: Seed Collecting for the Millennium Seed Bank Project*, Royal Botanic Gardens, Kew.

USFWS (U.S. Fish and Wildlife Service). 2009. *Deinandra conjugens* (Otay Tarplant) 5-Year Review: Summary and Evaluation. Prepared by the U.S. Fish and Wildlife Service, Carlsbad Fish and Wildlife Office, Carlsbad, California.

Wall, Michael. 2009. Seed Collection Guidelines for California Native Plant Species. Prepared for Rancho Santa Ana Botanic Garden.

## **1.15 Orcutt's Birds-Beak (*Dicranostegia orcuttiana*) – Category SL**

### **Management Units with Known Occurrences**

Orcutt's bird's-beak is endemic to southwestern San Diego County and northern Baja California, Mexico (Reiser 1994). It is found in maritime succulent scrub and in floodplain habitat in the Otay River Valley. Orcutt's bird's-beak currently occurs at 9 locations in MU3 (see online map). Three large occurrences ( $\geq 1,000$  individuals) are located in Otay River Valley, Cal Terraces, and Border Field State Park. There are 4 small occurrences ( $< 1,000$  individuals) and 2 with an unknown population size. Historically, there was also a small occurrence at Goat Canyon/Spooner's Mesa; however, the species was not detected there during 2005 and 2009 rare plant surveys (TAIC 2010).

### **Management Categorization Rationale**

Orcutt's bird's-beak should be managed as a Species Management Focus Category SL Species due to a moderate risk of loss from Conserved Lands in the MSPA and because managing vegetation alone will not ensure its persistence (see Vol. 1, Table 2-4). Orcutt's bird's-beak faces a moderate risk of loss due to its restricted distribution in San Diego County; limited suitable habitat; and annual, hemiparasitic life history traits. Existing occurrences in the MSPA are isolated and 4 are small in size and susceptible to demographic and environmental stochasticity.

The current threat to Orcutt's bird's-beak in MU3 is invasive nonnative plants. The most important stressors identified for Orcutt's bird's-beak in MU1, and which likely led to its extirpation from the unit, are invasive nonnative plants, off-highway vehicle activity, and illegal trails (TAIC 2010).

### **Management and Monitoring Approach**

The overarching goal for Orcutt's bird's-beak is to maintain or enhance existing occurrences and reestablish historic occurrences, as needed, to ensure multiple conserved occurrences with self-sustaining populations to increase resilience to environmental and demographic stochasticity, maintain genetic diversity, and ensure persistence over the long term ( $> 100$  years) in coastal sage scrub vegetation communities.

For the 2017–2021 planning cycle, the management and monitoring approach for Orcutt's bird's-beak is to:

- (1) Inspect Orcutt's bird's-beak occurrences annually on Conserved Lands (see Table of Occurrences) using the regional rare plant IMG monitoring protocol to record abundance and collect habitat and threats covariate data to determine management needs.
- (2) Conduct routine management actions identified through the IMG monitoring at Orcutt's bird's-beak occurrences on Conserved Lands (see Table of Occurrences). Depending on the type and level of threat, management should be conducted as needed, not necessarily every year, and using BMPs with precautions to do no harm.
- (3) Complete the study begun in 2016 to characterize the population genetic structure, gene flow, and genetic diversity for Orcutt's bird's-beak occurrences (see Table of Occurrences). The study will determine if there is evidence of mixed ploidy levels within or among occurrences; evaluate vulnerability of occurrences to genetic drift and loss of genetic diversity; assess the level of gene flow among occurrences; identify if there are signatures of genetic bottlenecks or low genetic diversity in occurrences that have undergone recent reductions; and look for evidence of local population adaptation. Based on the results of the genetic analyses, management recommendations will include whether common garden and reciprocal transplantations are necessary before proceeding with population enhancement or restoration and will provide specific recommendations for collecting, bulking, and distributing seed to enhance existing occurrences or establish new occurrences.
- (4) Survey historic Orcutt's bird's-beak locations to determine occurrence status; survey and delineate potentially suitable habitat for new occurrences; survey existing occurrences to identify the potential for enhancement and expansion; and at all sites collect data on occurrence status, habitat, and threats and determine management needs.
- (5) Enhance Orcutt's bird's-beak at the Cal Terraces/Dennery Canyon occurrence (see Table of Occurrences). Invasive plant control should be conducted using BMPs so that invasive plants are reduced to  $\leq 20\%$

absolute cover within the occurrence's occupied extent and adjacent suitable habitat.

- (6) Begin preparing an Orcutt's bird's-beak section in the MSP Seed Collection, Banking, and Bulking Plan that incorporates best science and management practices (Wall 2009; Royal Botanic Gardens, Kew 2016) to preserve genetic diversity and rescue occurrences in case of catastrophic disturbance. The plan should include recommendations from 2017–2019 seed collection and bulking efforts conducted by San Diego Zoo Institute for Conservation Research and from the 2016–2017 genetic study to collect and store seeds over the long term at a permanent, established conservation seed bank (e.g., Institute for Conservation Research Native Plant Seed Bank, Rancho Santa Ana Botanic Garden Seed Conservation Program) and for providing a source of seeds for management purposes. The plan should include recommendations for collecting and storing seeds for conservation banking; management-oriented research; rescuing occurrences after catastrophic disturbances; and seed bulking and outplanting to augment extant occurrences or to establish new occurrences with consideration of genetic implications for population sustainability.
- (7) Collect Orcutt's bird's-beak seed for conservation banking and bulk seed for enhancing and expanding the Cal Terraces/Dennery Canyon occurrence (see Table of Occurrences). Begin implementing high-priority actions for Orcutt's bird's-beak in the MSP Seed Collection, Banking, and Bulking Plan to collect and store seeds at a permanent seed bank and to provide propagules as needed for management-oriented research, existing population enhancement, and establishment of new occurrences.
- (8) Prepare an Orcutt's bird's-beak section in the MSP Rare Plant Management Plan that prioritizes management actions to maintain large occurrences and expand  $\geq 3$  small occurrences on Conserved Lands (see Table of Occurrences) based upon an assessment of data on occurrence status, habitat, and threats. Prepare management recommendations for reestablishment of historic occurrences or establishment of new occurrences if determined necessary for gene flow and for long-term persistence. Minimum criteria for enhancement are to reduce invasive annual nonnative plants and thatch to  $\leq 20\%$  absolute cover within the occurrence's maximum occupied extent and a surrounding buffer area

equal to 25% of this extent. Include recommendations from the 2017 genetics study, MSP Seed Collection, Banking, and Bulking Plan, relevant BMPs, and for monitoring the effectiveness of management actions. Implement the highest-priority management actions identified for Orcutt's bird's-beak in the MSP Rare Plant Management Plan and monitor effectiveness of implementation.

For details and the most up-to-date goals, objectives, and actions, go to the MSP Portal Orcutt's Bird's-Beak summary page: [http://portal.sdmmp.com/view\\_species.php?taxaid=834156](http://portal.sdmmp.com/view_species.php?taxaid=834156).

### **Orcutt's Bird's-beak References**

Reiser, C. H. 1994. *Rare Plants of San Diego County*. Imperial Beach, CA.

Royal Botanic Gardens, Kew. 2001. *Field Manual for Seed Collectors: Seed Collecting for the Millennium Seed Bank Project*, Royal Botanic Gardens, Kew.

TAIC (Technology Associates International Corporation). 2010. *Biological Monitoring Report for the Tijuana River Valley Regional Park (Monitoring Year 2009)*. Prepared by Technology Associates International Corporation for the County of San Diego Department of Parks and Recreation.

Wall, Michael. 2009. *Seed Collection Guidelines for California Native Plant Species*. Prepared for Rancho Santa Ana Botanic Garden.



## **1.16 Blochman's Dudleya (*Dudleya blochmaniae*) – Category SL**

### **Management Units with Known Occurrences**

Blochman's dudleya is a late spring-blooming (May–June) herbaceous perennial that occurs in dry stony places below 450 meters (1,500 feet) in elevation along the coast from San Luis Obispo County into southern San Diego County and northern Baja California, Mexico (CNPS 2016). It is associated with coastal bluff scrub, coastal sage scrub, grassland, and chaparral habitat. In San Diego County, this species is rare on coastal bluffs. There are 3 known locations within the MSPA; 2 of these are on Conserved Lands in MU3 (Borderfield State Park) and MU6 (Carlsbad Oaks Habitat Conservation Area) (see online map: <http://arcg.is/2hIPO1C>).

### **Management Categorization Rationale**

Blochman's dudleya should be managed as a Species Management Focus Category SL Species due to a high risk of loss from Conserved Lands in the MSPA and because managing the general vegetation community alone will not ensure persistence of the species (see Vol. 1, Table 2-4). It is at a high risk of loss as there are only 2 occurrences on Conserved Lands in a restricted distribution with very low population size, limited suitable habitat, and isolated occurrences with a small number of plants vulnerable to loss of genetic diversity and extirpation.

The primary threats to Blochman's dudleya are human trampling/recreation, invasive plants, encroaching native plants, erosion, and small population size (CNPS 2016).

### **Management and Monitoring Approach**

The overarching goal for Blochman's dudleya is to maintain or enhance existing occurrences and reestablish historical occurrences, as needed, to ensure multiple conserved occurrences with self-sustaining populations to increase resilience to environmental and demographic stochasticity, maintain genetic diversity, and ensure persistence over the long term (>100 years) in coastal sage scrub vegetation communities.

For the 2017–2021 planning cycle, the management and monitoring approach for Blochman's dudleya is to:

- (1) Inspect the 2 known occurrences on Conserved Lands annually to document abundance, record threats, and identify needed management actions.
- (2) Implement needed routine management actions as determined through monitoring.
- (3) Survey historical Blochman's dudleya locations to determine occurrence status; delineate potentially suitable habitat for new occurrences; identify the potential for enhancement and expansion; and collect data on occurrence status, habitat, threats, and management needs.
- (4) Use occurrence status and threat data to develop a section for Blochman's dudleya in the MSP Rare Plant Management Plan that prioritizes management actions.
- (5) Initiate preparation of a section for Blochman's dudleya in the MSP Seed Collection, Banking, and Bulking Plan that directs seed collection in the MSPA to ensure representation of different occurrences in the seed bank, provide propagules to preserve genetic diversity, support habitat restoration, and rescue occurrences in case of catastrophic disturbance.

For details and the most up-to-date goals, objectives, and actions, go to the MSP Portal Blochman's Dudleya summary page: [http://portal.sdmmp.com/view\\_species.php?taxaid=502165](http://portal.sdmmp.com/view_species.php?taxaid=502165).

### **Blochman's Dudleya References**

CNPS (California Native Plant Society) 2017. Rare Plant Program. Inventory of Rare and Endangered Plants (online edition, v8-02). California Native Plant Society, Sacramento, CA. Website <http://www.rareplants.cnps.org> [accessed 17 January 2017].

## **1.17 Short-leaved Dudleya (*Dudleya brevifolia*) – Category SL**

### **Management Units with Known Occurrences**

Short-leaved dudleya is endemic to San Diego County occurring only along the coast between Del Mar and La Jolla (Reiser 1994). The species is found in southern maritime chaparral on sandstone bluffs with Carlsbad gravelly loams soils and small reddish ironstone concretions. It is often in areas with native annual forbs and, while not a wetland species, it occurs in areas where soils remain saturated for a relatively long period after rain (City of San Diego n.d.).

There are 5 occurrences of short-leaved dudleya on Conserved Lands in MUs 6 and 7 (see Table of Occurrences or online map: <http://arcg.is/2kFLQXn>). There is 1 large short-leaved dudleya occurrence (>5,000 individuals) at Carmel Mountain Preserve in MU6 and 1 small occurrence (<500 individuals) at Skeleton Canyon in MU7. MU7 has a large and a small occurrence at Torrey Pines State Reserve and there is a moderate sized occurrence at Crest Canyon. Historic occurrences were found at La Jolla Canyon, Mount Soledad, and on mesas near McGonigle Canyon, Del Mar, and La Jolla (Reiser 1994). As a tiny succulent, short-leaved dudleya can only be adequately censused during the spring following the "corm" sprouting of leaves, and during the short flowering period (Reiser 2001).

### **Management Categorization Rationale**

Short-leaved dudleya should be managed as a Species Management Focus Category SL Species due to a moderate risk of loss from Conserved Lands in the MSPA and because managing southern maritime chaparral vegetation alone will not ensure persistence of the species (see Vol. 1, Table 2-4). This species is at moderate risk of loss from the MSPA since its entire range is a small area within 2 MUs along the coast between Del Mar and La Jolla and there are only 5 occurrences, 2 of which are small. It is also vulnerable as it is a perennial herb with moderate threat risks (see Vol. 3, App. 1, Species Profiles).

Threats to short-leaved dudleya include trampling by hikers, bikers, dogs, and equestrians; illegal trails; invasive plants; and erosion (City of San Diego 2001–2006, 2009–2012). The small number of occurrences in proximity makes short-leaved dudleya susceptible to environmental stochasticity and catastrophic disturbance.

## Management and Monitoring Approach

The overarching goal for short-leaved dudleya is to maintain or enhance existing occurrences to ensure multiple conserved occurrences with self-sustaining populations to increase resilience to environmental and demographic stochasticity, maintain genetic diversity, and ensure persistence over the long term (>100 years) in chaparral vegetation communities.

For the 2017–2021 planning cycle, the management and monitoring approach is to:

- (1) Continue annual inspections of short-leaved dudleya on Conserved Lands (see Table of Occurrences) using the regional rare plant IMG monitoring protocol to record abundance and collect covariate habitat and threats data to determine management needs. Conduct routine management actions identified through the IMG monitoring, with management conducted as needed.
- (2) Begin preparing a section for short-leaved dudleya in the MSP Seed Collection, Banking, and Bulking Plan to preserve genetic diversity and rescue occurrences in case of catastrophic disturbance.
- (3) Begin preparing a section for short-leaved dudleya in the MSP Rare Plant Management Plan that prioritizes management actions to maintain or expand conserved occurrences based upon an assessment of data on occurrence status habitat and threats. The plan will include recommendations for short-leaved dudleya from the MSP Seed Collection, Banking, and Bulking Plan, relevant BMPs, and recommendations for monitoring effectiveness of management actions.

For details and the most up-to-date goals, objectives, and actions, go to the MSP Portal Short-leaved Dudleya summary page: [https://portal.sdmmp.com/view\\_species.php?taxaid=502166](https://portal.sdmmp.com/view_species.php?taxaid=502166)

## Short-leaved Dudleya References

City of San Diego. n.d. In Preparation, Dudleya Brevifolia Restoration Plan.

City of San Diego. 2009. City of San Diego Rare Plant Monitoring Data 1999–2009. <https://www.sandiego.gov/sites/default/files/legacy/planning/programs/mscp/pdf/monitor/monitoringsummary1999to2009.pdf>.

City of San Diego. 2010. City of San Diego Rare Plant Monitoring Data.

City of San Diego. 2011. City of San Diego Rare Plant Monitoring Data.

City of San Diego. 2012. City of San Diego Rare Plant Monitoring Data.

Reiser, C. H. 1994. Rare Plants of San Diego County. Imperial Beach, CA.

Reiser, C. H. 2001. Rare Plants of San Diego County. San Diego, CA: Aquifer Press.

## **1.18 Variegated Dudleya (*Dudleya variegata*) – Category SS**

### **Management Units with Known Occurrences**

Variegated dudleya is a corm-like perennial associated with clay soils near the coast in southwestern San Diego County and northwestern Baja California, Mexico (Reiser 2001). There are 34 known occurrences on Conserved Lands in MUs 2, 3, 4, and 6. Variegated dudleya occurs in openings in sage scrub and chaparral, isolated rocky substrates in open grasslands, and occasionally in clay soils in proximity to vernal pools (see Table of Occurrences and online map: <http://arcg.is/2iBE67T>).

### **Management Categorization Rationale**

Variegated dudleya should be managed as a Species Management Focus Category SS Species because its persistence is at lower risk of loss compared to SL and SO species; however, this species still requires species specific management actions (see Vol. 1, Table 2-4). Threats to variegated dudleya include invasive nonnative plants, human use, ORV traffic, and urban development.

### **Management and Monitoring Approach**

The overarching goal for variegated dudleya is to maintain or enhance occurrences with self-sustaining populations to increase resilience to environmental and demographic stochasticity, maintain genetic diversity, and improve chances of persistence over the long term (>100 years) in chaparral and coastal sage scrub vegetation communities.

For the 2017–2021 planning cycle, the management and monitoring approach for variegated dudleya is to inspect conserved occurrences every 2 years starting in 2018 to document abundance, record threats, and identify needed management actions. Implement routine management as determined during monitoring.

For details and the most up-to-date goals, objectives, and actions, go to the MSP Portal Variegated Dudleya summary page: [https://portal.sdmmp.com/view\\_species.php?taxaid=502182](https://portal.sdmmp.com/view_species.php?taxaid=502182)

### **Variegated Dudleya References**

Reiser, C. H. 2001. *Rare Plants of San Diego County*. San Diego, CA: Aquifer Press.

## 1.19 Sticky Dudleya (*Dudleya viscida*) – Category SS

### Management Units with Known Occurrences

Sticky dudleya is distributed in southwestern California and northwest Baja California, Mexico (Munz 1974; Bartel 1993). The species occurs in the northwest portion of San Diego County. It is found on steep rocky north-facing slopes in chaparral and coastal sage scrub vegetation (Reiser 2001; CNPS 2016). It is often found on gabbroic rock and growing in very shallow soils or from cracks on vertical rock.

There are 4 sticky dudleya occurrences on Conserved Lands in the MSPA in MU6 (see Table of Occurrences or online map: <http://arcg.is/2kFBBIW>). One large occurrence was salvaged by California Department of Transportation during construction of Highway 76 and in 1995–1996 transplanted on the cut-and-fill slopes above the road. Plants were detected in 2006, but the current size of the occurrence was not reported. Box Canyon along San Marcos Creek in the Rancho La Costa Habitat Conservation Area has over 6,000 individuals and nearby La Costa Canyon Park has about 2,000 plants. An occurrence of 1,300 plants was mapped in 2000 along Escondido Creek in the Elfin Forest area. A fourth occurrence of a maximum of 5,658 plants on the bluffs north of the San Luis Rey River (D. Mayer, pers. comm.) was recorded in 2016. Historically, in the 1990s, a sixth occurrence was documented in Santa Fe Valley, but the current status is unknown. MCB Camp Pendleton supports 5 occurrences outside the MSPA.

### Management Categorization Rationale

Sticky dudleya is a Species Management Focus Category SS Species because of a low risk of loss from Conserved Lands in the MSPA (see Vol. 1, Table 2-4). Despite this low risk it should be managed at a species-specific level because of its extremely limited distribution in 1 MU in the MSPA and the low number of occurrences, the majority of which are small and isolated (see Vol. 3, App. 1, Species Profiles).

Sticky dudleya is threatened by the release of water from upstream reservoirs, trampling by hikers and climbers, and invasive plants, especially those escaped from cultivation in the urban-wildland interface (M. Dodero, pers. comm.; M. Spiegelberg, pers. comm.). It is also threatened by development and road construction (CNPS 2016).

## Management and Monitoring Approach

The overarching goal for sticky dudleya is to maintain or enhance existing occurrences to ensure multiple conserved occurrences with self-sustaining populations to increase resilience to environmental and demographic stochasticity, maintain genetic diversity, and ensure persistence over the long term (>100 years) in chaparral and coastal sage scrub vegetation communities.

For the 2017–2021 planning cycle, the management and monitoring approach is to inspect sticky dudleya occurrences on Conserved Lands (see Table of Occurrences) using the regional rare plant IMG monitoring protocol to record abundance and collect habitat and threats covariate data to determine management needs and conduct routine management actions as identified through the IMG monitoring. Depending on the type and level of threat, management should be conducted as needed, not necessarily every year, and using BMPs with precautions to do no harm.

For details and the most up-to-date goals, objectives, and actions, go to the MSP Portal Sticky Dudleya summary page: [https://portal.sdmmp.com/view\\_species.php?taxaid=502185](https://portal.sdmmp.com/view_species.php?taxaid=502185)

## Sticky Dudleya References

Bartel, J. A. 1993. Dudleya. In *The Jepson Manual, Higher Plants of California*, J. C. Hickman. Berkeley, California: University of California Press.

CNPS (California Native Plant Society). 2016. CNPS Rare Plant Program. *Inventory of Rare and Endangered Plants* (Online Edition, v8-02). <http://www.rareplants.cnps.org/detail/583.html>.

CNPS. 2016. CNPS Rare Plant Program. *Inventory of Rare and Endangered Plants* (Online Edition, v8-02). *California Native Plant Society*. <http://www.rareplants.cnps.org>.

Munz, P. A. 1974. *A Flora of Southern California*. Berkeley, California: University of California Press.

Reiser, C. H. 2001. *Rare Plants of San Diego County*. San Diego, CA: Aquifer Press.



## **1.20 Coast Wallflower (*Erysimum ammodendrum*) – Category SL**

### **Management Units with Known Occurrences**

Coast wallflower is a small biannual or short-lived perennial that is found on sandstone substrates and dunes along the coastal strand in California, from Santa Cruz County south to San Diego County (Reiser 1994; Calflora 2012). Within the MSPA, there are 3 extant coast wallflower occurrences on Conserved Lands in MUs 6 and 7 (see Table of Occurrences or online map: <http://arcg.is/2jYTZ4y>). In MU6, coast wallflower is found in east Del Mar at Overlook Park (SDNHM 2013; CCH 2013) and in Gonzales Canyon at Del Mar Highlands (K. Roeland, pers. comm.). Nearby in MU7, coast wallflower is found at Crest Canyon (SDNHM 2013). In San Diego County and outside of the MSPA, there are occurrences of coast wallflower at MCB Camp Pendleton (CCH 2013; SDNHM 2017). Historically, the species was found at Torrey Pines State Reserve, Peñasquitos Lagoon, Carmel Valley, Encinitas, and Sunset Cliffs (Reiser 1994).

### **Management Categorization Rationale**

Coast wallflower should be managed as a Species Management Focus Category SL Species due to a high risk of loss from Conserved Lands in the MSPA and because managing coastal sandstone outcrops and dunes alone will not ensure its persistence (see Vol. 1, Table 2-4). Coast wallflower is at high risk of loss from the MSPA, as it is a perennial herb with only 3 occurrences on Conserved Lands and with very limited suitable habitat. The 3 conserved occurrences are vulnerable to loss of genetic diversity and extirpation due to environmental or demographic stochasticity and catastrophic disturbance.

### **Management and Monitoring Approach**

The overarching goal for coast wallflower is to maintain or enhance existing occurrences and establish new occurrences, as needed, to ensure multiple conserved occurrences with self-sustaining populations to increase resilience to environmental and demographic stochasticity, maintain genetic diversity, and improve chances of persistence over the long term (>100 years) in chaparral, coastal bluff, coastal dune, and coastal sage scrub vegetation communities.

For the 2017–2021 planning cycle, the management and monitoring approach for Coast wallflower is to:

- (1) Inspect occurrences of coast wallflower on Conserved Lands (see Table of Occurrences) using the regional IMG monitoring protocol to record status and to collect habitat and threats covariate data to determine management needs, with repeat monitoring occurring every 2 years after 2017. Conduct routine management actions as identified through the IMG monitoring where management should be conducted as needed depending on the threat while using BMPs with precautions to do no harm.
- (2) Perform multiple surveys: to delineate potentially suitable habitat for new occurrences, at historical locations to determine occurrence status, at existing occurrence sites to identify the potential for enhancement and expansion. Collect data on occurrence status, habitat, and threats, and determine management needs.
- (3) Begin preparing a section in the MSP Seed Collection, Banking, and Bulking Plan to preserve genetic diversity and rescue occurrences in case of catastrophic disturbance.
- (4) Begin preparing a section in the MSP Rare Plant Management Plan that prioritizes management actions to maintain and expand conserved occurrences based upon an assessment of data on occurrence status, habitat, and threats where management recommendations for reestablishment of historical occurrences or establishment of new occurrences are prioritized in suitable habitat, as needed, to achieve  $\geq 4$  occurrences with self-sustaining populations on Conserved Lands.

For details and the most up-to-date goals, objectives, and actions, go to the MSP Portal Coast Wallflower summary page: [https://portal.sdmmp.com/view\\_species.php?taxaid=22928](https://portal.sdmmp.com/view_species.php?taxaid=22928)

## Coast Wallflower References

Calflora: Information on California plants for education, research and conservation. 2012. Berkeley, California: The Calflora Database <http://www.calflora.org/> Accessed 2012.

CCH (Consortium of California Herbaria). 2013. <http://ucjeps.berkeley.edu/consortium/> Accessed 2013.

Reiser, C. H. 1994. *Rare Plants of San Diego County*. Imperial Beach, CA.

SDNHM (San Diego Natural History Museum). 2013. *San Diego County Plant Atlas*. <http://www.sdnhm.org/science/botany/projects>. Accessed 2013.

SDNHM. 2017. *San Diego County Plant Atlas*. <http://www.sdnhm.org/science/botany/projects> Accessed 2017.

## **1.21 Mexican Flannelbush (*Fremontodendron mexicanum*) – Category SL**

### **Management Units with Known Occurrences**

Mexican flannelbush is endemic to southern San Diego County and northern Baja California, occurring in Tecate cypress forest and chaparral habitats (Reiser 1994). This species grows on alluvial benches associated with ephemeral drainages and associated canyon slopes, with an elevation range from sea level to 1,000 meters (USFWS 2009). The genus is considered a relic from millions of years ago when the climate was more tropical in this region (Kelman 1991).

All Mexican flannelbush occurrences in the United States are in MU3 and are conserved or will be conserved based upon Otay Ranch Agreements. Three natural occurrences in adjacent canyons are on Otay Mountain and 1 small transplanted occurrence is near San Miguel Mountain (see Table of Occurrences). The entire natural distribution of Mexican flannelbush totals approximately 6,000 individuals with a single occurrence of <20 individuals in Baja California (USFWS 2009). Historical presumed native occurrences have been extirpated from Jamul Valley, Point Loma, and the Border Monument (USFWS 2009; CDFW 2012). Historical reports of Mexican flannelbush in MUs 2, 4, and 8 are thought to be planted cultivars rather than natural occurrences.

### **Management Categorization Rationale**

Mexican flannelbush should be managed as a Species Management Focus Category SL Species due to a high risk of loss from Conserved Lands in the MSPA and because managing the general vegetation community alone will not ensure persistence of the species (see Vol. 1, Table 2-4). It is considered at high risk of loss because it has an extremely limited distribution, is vulnerable to catastrophic disturbance, and has a high degree of threat (see Vol. 3, App. 1, Species Profiles). This species was listed as endangered in 1998 by USFWS (USFWS 2009). It is ranked as a very high recovery priority by USFWS because of the degree of threat and the high potential for recovery.

The low number of individuals makes the species vulnerable to adverse genetic effects. The entire natural U.S. occurrence representing 99.9% of the individuals of this species is restricted to 3 drainages in proximity. This means that disease or insect infestations could spread and affect all individuals. Additionally, due to this proximity, this species is vulnerable to extinction from too frequent fire exposure.

Following the 2003 and 2007 wildfires, Mexican flannelbush resprouted and spread in occupied drainages, but so did invasive nonnative tamarisk (*Tamarix* spp.; USFWS 2009).

Border Patrol activities also have the potential to disturb occurrences through all-terrain vehicle use in canyon bottoms, construction of roads in canyon bottoms, and cut-and-fill work associated with road construction (USFWS 2009). However, the Department of Homeland Security typically works with USFWS and BLM to minimize their impacts in the Otay Mountain Wilderness Area.

### **Management and Monitoring Approach**

The overarching goal for Mexican flannelbush is to maintain or enhance existing occurrences to ensure multiple conserved occurrences with self-sustaining populations to increase resilience to environmental and demographic stochasticity, maintain genetic diversity, and ensure persistence over the long term (>100 years) in chaparral vegetation communities.

For the planning cycle of 2017–2021, the management and monitoring approach is to:

- (1) Inspect Mexican flannelbush occurrences on Conserved Lands (see Table of Occurrences) using the regional IMG monitoring protocol to estimate abundance and collect covariate data on tamarisk and other types of threats, and determine management needs. After 2017, repeat monitoring will occur every 3 years, unless an occurrence is small (<100 individuals) or faces a high degree of threat, in which case it will be monitored annually.
- (2) Continue routine management actions identified through the IMG monitoring that began in 2014 at Mexican flannelbush occurrences on Conserved Lands (see Table of Occurrences). Depending on the type and level of threat, management should only be conducted as needed, not necessarily every year, and using BMPs with precautions to do no harm.

For details and the most up-to-date goals, objectives, and actions, go to the MSP Portal Mexican Flannelbush summary page: [https://portal.sdmmp.com/view\\_species.php?taxaid=21581](https://portal.sdmmp.com/view_species.php?taxaid=21581).

**Mexican Flannelbush References**

CDFW (California Department of Fish and Wildlife). 2012. California Natural Diversity Database. Species occurrences shapefile, accessed 2012 and 2013.

Kelman, W. M. 1991. A Revision of *Fremontodendron* (Sterculiaceae). *Systematic Biology* 16(1):3–20.

Reiser, C. H. 1994. *Rare Plants of San Diego County*. Imperial Beach, CA.

USFWS (U.S. Fish and Wildlife Services). 2009. *Fremontodendron Mexicanum (Mexican Flannelbush) 5-Year Review: Summary and Evaluation*. Carlsbad, California.

## **1.22 Orcutt's Hazardia (*Hazardia orcuttii*) – Category SL**

### **Management Units with Known Occurrences**

Orcutt's hazardia is native to only 1 location in central coastal San Diego County with 9 other known occurrences in northern Baja California (Oberbauer 1981; Vourlitis et al. 2009; USFWS 2012). It occurs in sandstone openings in Diegan coastal sage scrub and southern maritime chaparral. Within this habitat it occurs in soils with a higher percent clay, soil organic matter, nitrogen, and soil moisture than areas without the shrub (Vourlitis et al. 2009).

Besides the natural occurrence of Orcutt's hazardia in MU6, there are 4 transplanted occurrences in MUs 6 and 7 that originated from the native occurrence (see Table of Occurrences). In MU6, Orcutt's hazardia occurs in Manchester Mitigation Bank (2 occurrences), Rancho La Costa, and Kelly Ranch. In MU7, it occurs in the San Elijo Lagoon Reserve. Six of the 9 extant occurrences known from Baja California have <25 plants and there has been recent extirpation of 5 other Mexican occurrences (USFWS 2012) (see online map: <http://arcg.is/2iBCBqC>).

### **Management Categorization Rationale**

Orcutt's hazardia should be managed as a Species Management Focus Category SL Species due to a high risk of loss from Conserved Lands in the MSPA and because managing the general vegetation community alone will not ensure persistence of the species (see Vol. 1, Table 2-4). There is a high risk of loss from the MSPA due to the small number of native and transplanted occurrences in proximity, relatively low number of plants in the MSPA, and the high risk of threats (see Vol. 3, App. 1, Species Profiles). This species is listed as threatened by the state of California and was recently designated by the federal government as warranted for listing as an endangered species, although the listing was precluded at this time due to other priorities (USFWS 2012).

Threats to Orcutt's hazardia include potential for extirpation from a catastrophic disturbance such as fire or disease (USFWS 2012). Although present in a fire adapted habitat, the lack of seedlings and low seed germination rates at the native occurrence could make it vulnerable to loss from a fire. The low rate of reproduction could also lead to occurrence decline over time. The small native occurrence is disjunct from other native occurrences in Baja California and is the

source of propagules for the transplanted occurrences, indicating the potential for low genetic variation and inbreeding depression. The native and translocated occurrences are vulnerable to genetic stochasticity. Insects or fungal agents were documented damaging flowers and reducing germination during 1 growing season (Vourlitis et al. 2006) and it is unknown whether this is a recurring threat. Invasive, nonnative purple false brome (*Brachipodium distachylon*) is a potential threat to 1 of the transplanted occurrences (Center for Natural Lands Management unpub. data 2013).

### Management Approach

The overarching goal for Orcutt's hazardia is to maintain or enhance existing occurrences to ensure multiple conserved occurrences with self-sustaining populations to increase resilience to environmental and demographic stochasticity, maintain genetic diversity, and ensure persistence over the long term (>100 years) in chaparral and coastal sage scrub vegetation communities.

For the planning cycle of 2017–2021, the management and monitoring approach is to:

- (1) Prepare an Orcutt's hazardia section in the MSP Seed Collection, Banking, and Bulking Plan to preserve genetic diversity and rescue occurrences in case of catastrophic disturbance. Implement high-priority actions for Orcutt's hazardia in the MSP Seed Collection, Banking, and Bulking Plan to collect and store seeds at a permanent seed bank and to provide propagules as needed for management-oriented research, existing population enhancement, and establishment of new occurrences.
- (2) Prepare an Orcutt's hazardia section in the MSP Rare Plant Management Plan that prioritizes management actions to maintain or enhance occurrences on Conserved Lands (see Table of Occurrences) based upon an assessment of data on occurrence status, habitat, and threats. Implement the highest-priority management actions identified for Orcutt's hazardia in the MSP Rare Plant Management Plan and monitor effectiveness of implementation.
- (3) Inspect Orcutt's hazardia occurrences on Conserved Lands (see Table of Occurrences) using the regional rare plant IMG monitoring protocol to record abundance and collect habitat and threats covariate data to



determine management needs; repeat monitoring every 2 years after 2018. Conduct routine management actions identified.

- (4) Conduct a study to determine the population dynamics of Orcutt's hazardia in response to natural and altered fire frequencies that may affect successional processes and population dynamics. The study should begin when the next fire burns an Orcutt's hazardia occurrence to research post-fire recovery mechanisms (e.g., resprouter vs. obligate seeder) and circumstances in which post-fire management is necessary to facilitate robust post-fire recovery of Orcutt's hazardia.

For details and the most up-to-date goals, objectives, and actions, go to the MSP Portal Orcutt's Hazardia summary page: [https://portal.sdmmp.com/view\\_species.php?taxaid=502882](https://portal.sdmmp.com/view_species.php?taxaid=502882).

### **Orcutt's Hazardia References**

Oberbauer, T. A. 1981. Noteworthy Collections: Hazardia Orcuttii (Gray) Greene (Compositae). *Madroño* 28:38–39.

USFWS (U.S. Fish and Wildlife Service). 2012. *U.S. Fish and Wildlife Service Species Assessment and Listing Priority Assignment Form*.

Vourlitis, George L., J. Kirker, and K. Coler. 2006. Research for the Management and Conservation of Orcutt's Hazardia (Hazardia Orcuttii) Final Report. Unpublished Report Prepared for California Department of Fish and Game, Meredith Osborne, Contract Manager. (*Contract: PO285014*).

Vourlitis, G. L., J. Miller, and K. Coler. 2009. Soil and Community Characteristics Associated with Hazardia Orcuttii (Asteraceae). *Madrono* 56(4):229–237.

### **1.23 Heart-leaved Pitcher Sage (*Lepichinia cardiophylla*) – Category SL**

#### **Management Units with Known Occurrences**

Heart-leaved pitcher sage is a shrub that occurs in chaparral and oak woodlands in southern California and Baja California, Mexico (Reiser 1994). In southern California, it is found mainly in the Santa Ana Mountains. Within the MSPA, two small conserved occurrences (<500 individuals) are in relative proximity in MU8 at Wilderness Gardens and Mount Olympus Preserves (see Table of Occurrences or online map: <http://arcg.is/2jZf7Yp>). Heart-leaved pitcher sage currently occurs on private lands near Iron Mountain and was reported from a couple of locations in that area in the late 1970s.

#### **Management Categorization Rationale**

Heart-leaved pitcher sage should be managed as a Species Management Focus Category SL Species due to a high risk of loss from Conserved Lands in the MSPA and because managing chaparral and oak woodlands alone will not ensure its persistence (see Vol. 1, Table 2-4). It is at high risk of loss from the MSPA because there are only 2 small occurrences currently reported on Conserved Lands (see Vol. 3, Species Profiles). The 2 conserved occurrences of heart-leaved pitcher sage are vulnerable to loss of genetic diversity and extirpation due to environmental and demographic stochasticity and catastrophic disturbance.

#### **Management and Monitoring Approach**

The overarching goal for heart-leaved pitcher sage is to maintain or enhance existing occurrences and establish new occurrences, as needed, to ensure multiple conserved occurrences with self-sustaining populations to increase resilience to environmental and demographic stochasticity, maintain genetic diversity, and ensure persistence over the long term (>100 years) in chaparral and oak woodland vegetation communities.

For the 2017–2021 planning cycle, the management and monitoring approach for heart-leaved pitcher sage is to inspect any extant occurrences discovered on Conserved Lands and repeat monitoring every 2 years using the regional monitoring protocol to record population abundance and collect habitat and threats covariate data to determine management needs. Conduct routine management actions identified through the IMG monitoring if occurrences are

found on Conserved Lands where management should be conducted as needed depending on the threats while using BMPs with precautions to do no harm.

For details and the most up-to-date goals, objectives, and actions, go to the MSP Portal Heart-leaved Pitcher Sage summary page:  
[https://portal.sdmmp.com/view\\_species.php?taxaid=32553](https://portal.sdmmp.com/view_species.php?taxaid=32553)

### **Heart-leaved Pitcher Sage References**

Reiser, C. H. 1994. *Rare Plants of San Diego County*. Imperial Beach, CA.

## **1.24 Jennifer's Monardella (*Monardella stoneana*) – Category SL**

### **Management Units with Known Occurrences**

Jennifer's monardella is a narrow endemic found from southern San Diego County and northern Baja California, Mexico (Elvin and Sanders 2003). All known sites are found in MU3 in intermittent streams and rocky gorges that flow for several weeks or months during or after the rainy season. It is often found growing among boulders or growing in cracks of bedrock in drainages, surrounded by chaparral or coastal sage scrub (Elvin and Sanders 2003). There are currently only 12 known occurrences, 10 in the United States and 2 just north of Ensenada in Baja, California, Mexico. The 10 U.S. occurrences all occur on Conserved Lands within MU3. All 10 U.S. occurrences are found within 5 canyons in 2 watersheds at Marron Valley Mitigation Bank, Otay Ranch Preserve, Otay Lake Cornerstone Lands, Otay Mountain Wilderness Area, Otay Mountain Ecological Reserve, BLM lands, and Marron Valley (see Table of Occurrences, and online map: <http://arcg.is/2h1S1K9>). Many sites on adjacent ownerships are considered part of the same occurrence (CDFW 2013).

### **Management Categorization Rationale**

Jennifer's monardella should be managed as a Species Management Focus Category SL Species due to a high risk of loss from Conserved Lands in the MSPA and because managing the general vegetation community alone will not ensure persistence of the species (see Vol 1, Table 2-4). It is at a high risk of loss as there are only 10 occurrences on Conserved Lands in a restricted distribution with very low population size, limited suitable habitat, and isolated occurrences with a small number of plants vulnerable to loss of genetic diversity and extirpation as a result of environmental and demographic stochasticity or catastrophic disturbance.

The primary threats to Jennifer's monardella are altered fire regime, drought, altered hydrology/erosion, small population size, and invasive plants. Because Jennifer's monardella is typically found in drainages, it can be susceptible to post-fire erosion impacts, which can lead to habitat loss and degradation. At least 8 of the 10 known occurrences burned in both the 2003 Otay wildfire and the 2007 Harris Fire. All occurrences have burned more than 3 times in the last 100 years and have a high ignition risk. An altered fire regime could affect occurrence demographics and exacerbate threats posed by invasive plant species and erosion.

## Management and Monitoring Approach

The overarching goal for Jennifer's monardella is to maintain or enhance existing occurrences to ensure multiple conserved occurrences with self-sustaining populations to increase resilience to environmental and demographic stochasticity, maintain genetic diversity, and ensure persistence over the long term (>100 years) in chaparral vegetation communities.

For the 2017 through 2021 planning period, the management and monitoring approach for Jennifer's monardella is to inspect the 10 known occurrences every 3 years starting in 2019 to record abundance, identify threats and needed management actions, and implement needed routine management actions as determined through monitoring. In the event of a wildfire, spring-summer surveys should be conducted for 3 years following fire to document recovery and to identify needed management actions.

For details and the most up-to-date goals, objectives, and actions, go to the MSP Portal Jennifer's Monardella summary page: [http://portal.sdmmp.com/view\\_species.php?taxaid=832834](http://portal.sdmmp.com/view_species.php?taxaid=832834)

## Jennifer's Monardella References

CDFW (California Department of Fish and Wildlife). 2013. California Natural Diversity Database. Occurrence report, *Monardella stoneana*.

Elvin, M. A, and A. C. Sanders. 2003. A New Species of Monardella (lamiaceae) from Baja California, Mexico, and Southern California, United States. *Novon* 13:425–432.

## **1.25 Willowy Monardella (*Monardella viminea*) – Category SL**

### **Management Units with Known Occurrences**

Willowy monardella is a narrow endemic in central San Diego County (USFWS 2012a) with small isolated occurrences in 3 watersheds north of Kearny Mesa (Elvin and Sanders 2003). It is found in coastal sage scrub and riparian scrub in sandy washes and on adjacent banks with ephemeral water flow where water only flows for 24 to 48 hours following rain events. The soil requirements include coarse sandy grains and sediments, and cobble deposits (Scheid 1985). Willowy monardella needs semi-open canopies with limited herbaceous understory.

This species has only 8 known occurrences on Conserved Lands in the MSPA, with only 1 of those 8 occurrences being a large occurrence ( $\geq 100$  plants since 2004). That large occurrence is at Sycamore Canyon, while the 7 small occurrences ( $< 100$  plants since 2004) are found in Sycamore, West Sycamore, Spring, Lopez, and Flander's Canyons in MUs 4 and 6 (see Table of Occurrences or online map: <http://arccg.is/2kFPS21>). The small willowy monardella population is declining with several recent extirpations (USFWS 2012a). Outside the MSPA, willowy monardella is found on MCAS Miramar in Sycamore, San Clemente, West Sycamore, Spring, Elanus, and Murphy Canyons and their tributaries (USFWS 2012b). There is also a transplanted occurrence on private lands in Carroll Canyon (USFWS 2011, 2012b). Native occurrences of this species have been extirpated from Carroll and Cemetery Canyons (USFWS 2012a).

### **Management Categorization Rationale**

Willowy monardella should be managed as a Species Management Focus Category SL Species due to a high risk of loss from Conserved Lands in the MSPA and because managing the general vegetation community alone will not ensure persistence of the species (see Vol. 1, Table 2-4). It is at a high risk of loss as there are only 8 occurrences in a restricted distribution, limited suitable habitat, and isolated occurrences with a small number of plants vulnerable to loss of genetic diversity and extirpation as a result of environmental and demographic stochasticity or catastrophic disturbance (see Vol. 3, App. 1, Species Profiles). Willowy monardella occurrences also face a high degree of threat and have declined significantly since 2002 (USFWS 2012a).

Given the limited distribution and abundance of willowy monardella on Conserved Lands, the species is more vulnerable to natural catastrophes and stochastic demographic, genetic, and environmental events. A significant threat to willowy monardella is altered hydrology, as a result of urbanization, that causes severe erosion and undercutting and the washing away of plants (Kelly and Burrascano 2007; City of San Diego 2009; City of San Diego 2000–2003, 2005–2012). Invasive nonnative plant species and erosion are impacting all occurrences in the MSPA for which there is information on threats (see Table of Occurrences). Five of the 6 occurrences on Conserved Lands burned during the 2003 Cedar wildfire. An altered fire regime could affect occurrence demographics and exacerbate threats posed by invasive plant species and erosion. There is also potential for impacts from feral pigs that have recently invaded the San Diego River watershed and could spread downstream into tributary canyons where willowy monardella occurs. As a perennial herb, there are indications this species is also vulnerable to the effect of prolonged drought, which may be contributing to the decline (City of San Diego 2003, 2004; USFWS 2012a).

### **Management and Monitoring Approach**

The overarching goal for willowy monardella is to maintain or enhance existing occurrences and establish new occurrences, as needed, to ensure multiple conserved occurrences with self-sustaining populations to increase resilience to environmental and demographic stochasticity, maintain genetic diversity, and ensure persistence over the long term (>100 years) in coastal sage scrub vegetation communities.

For the 2017–2021 planning cycle, the management and monitoring approach is to:

- (1) Inspect willowy monardella occurrences annually on Conserved Lands (see Table of Occurrences) using the regional rare plant IMG monitoring protocol to record abundance and collect habitat and threats covariate data to determine management needs. Conduct routine management actions identified through the IMG monitoring.
- (2) Complete the study begun in 2016 to characterize the population genetic structure, gene flow, and genetic diversity for willowy monardella occurrences (see Table of Occurrences).

- (3) Conduct an evaluation of hydrological processes at willowy monardella occurrences following a fire to determine risks from erosion and flooding, and prepare a report with prioritized management recommendations to reduce risk to population persistence and sustainability. Implement the highest-priority management actions identified in the willowy monardella post fire hydrological evaluation and monitor effectiveness of implementation.
- (4) Survey historical willowy monardella locations to determine occurrence status; survey and delineate potentially suitable habitat for new occurrences; survey existing occurrences to identify the potential for enhancement and expansion; and at all sites collect data on occurrence status, habitat, and threats and determine management needs.
- (5) Prepare a section for willowy monardella in the MSP Seed Collection, Banking, and Bulking Plan that incorporates best science and management practices (Royal Botanic Gardens, Kew 2001; Wall 2009) to preserve genetic diversity and rescue occurrences in case of catastrophic disturbance. Begin implementing high-priority actions for willowy monardella in the MSP Seed Collection, Banking, and Bulking Plan to collect and store seeds at a permanent seed bank and to provide propagules as needed for management-oriented research, existing population enhancement, and establishment of new occurrences.
- (6) Prepare a section for willowy monardella in the MSP Rare Plant Management Plan that prioritizes management actions to maintain the large occurrence and enhance  $\geq 3$  small occurrences on Conserved Lands (see Table of Occurrences) based upon an assessment of data on occurrence status, habitat, and threats. Begin implementing highest-priority management actions identified for willowy monardella in the MSP Rare Plant Management Plan and monitor effectiveness of implementation.

For details and the most up-to-date goals, objectives, and actions, go to the MSP Portal Willowy Monardella summary page: [https://portal.sdmmp.com/view\\_species.php?taxaid=833060](https://portal.sdmmp.com/view_species.php?taxaid=833060).



## Willow Monardella References

- City of San Diego. 2009. "City of San Diego Rare Plant Monitoring Data 1999–2009."  
<https://www.sandiego.gov/sites/default/files/legacy/planning/programs/mscp/pdf/monitor/monitoringsummary1999to2009.pdf>.
- City of San Diego. 2010. City of San Diego Rare Plant Monitoring Data.
- City of San Diego. 2011. City of San Diego Rare Plant Monitoring Data.
- City of San Diego. 2012. City of San Diego Rare Plant Monitoring Data.
- Elvin, M. A., and A. C. Sanders. 2003. A New Species of *Monardella* (Lamiaceae) from Baja California, Mexico, and Southern California, United States. *Novon* 13:425–432.
- Kelly, M., and C. Burrascano. 2007. Lopez Canyon Willow Monardella Project 2001 to July 2006. *Canyon News* 21:1–6.
- Royal Botanic Gardens, Kew. 2001. *Field Manual for Seed Collectors: Seed Collecting for the Millennium Seed Bank Project*, Royal Botanic Gardens, Kew.
- Scheid, G. A. 1985. *Habitat Characteristics of Willow Monardella, Monardella Linoides spp. Viminea, in San Diego County*. Rept. Submitted to Caltrans; San Diego State University.
- USFWS (U.S. Fish and Wildlife Service). 2011. Endangered and Threatened Wildlife and Plants: Revised Endangered Status, Revised Critical Habitat Designation, and Taxonomic Revision for *Monardella Linoides* Ssp. *Viminea*; Proposed Rule. In *Federal Register* 76:33880–921.
- USFWS. 2012a. Endangered and Threatened Wildlife and Plants: Revised Endangered Status, Revised Critical Habitat Designation, and Taxonomic Revision for *Monardella Linoides* Ssp. *Viminea*; Final Rule. In *Federal Register* 77:13394–447.

USFWS. 2012b. *Monardella Viminea (Willow Monardella): Five Year Review Short Form Summary*. Prepared by U.S. Fish and Wildlife Service, Carlsbad Fish and Wildlife Office.

Wall, M. 2009. *Seed Collection Guidelines for California Native Plant Species*. Prepared for Rancho Santa Ana Botanic Garden.

## **1.26 Chaparral Nolina (*Nolina cismontana*) – Category SL**

### **Management Units with Known Occurrences**

Chaparral nolina occurs in coastal sage scrub and open chaparral habitats in foothills from Ventura County south to San Diego County (Reiser 1994; Hess and Dice 1995; CNPS 2011). In the MSPA, the only known occurrence on Conserved Lands in the MSPA is in MU5 at Hellhole Canyon Preserve (see Occurrence Table or online map: <http://arcg.is/2kFKRpZ>); however, another occurrence was found in 2001 in MU4 on Conserved Lands in Cleveland National Forest (CNF), though its status is currently unknown (SANBIOS 2015). The occurrence on CNF lands burned in 2003 and 2007 and may no longer be extant. It was detected in 2005 following the 2003 fire; however, it was not observed during surveys in 2008 after the 2007 fire. Outside the MSPA, 3 occurrences were found on U.S. Forest Service lands at Viejas Mountain (CCH 2013; SDNHM 2013). Three more occurrences were found in MU8 on private, unconserved lands in the Pala area (SANBIOS 2013; SDNHM 2013). In 2015, 1 occurrence was found on military lands (CCH 2017; SDNHM 2017).

### **Management Categorization Rationale**

Chaparral nolina should be managed as a Species Management Focus Category SL Species due to a high risk of loss from Conserved Lands in the MSPA and because managing chaparral and coastal sage scrub habitats alone will not ensure its persistence (see Vol. 1, Table 2-4). Chaparral nolina is at high risk of loss from the MSPA as there are only 1 to 2 recent occurrences on Conserved Lands. The conserved occurrences are vulnerable to loss of genetic diversity and extirpation due to environmental and demographic stochasticity and catastrophic disturbance, such as another major wildfire. An altered fire regime (too frequent fire) may have already impacted the CNF occurrence as it may no longer be extant after the 2003 and 2007 wildfires.

### **Management and Monitoring Approach**

The overarching goal for chaparral nolina is to maintain or enhance existing occurrence(s) and establish new occurrences, as needed, so there are multiple, self-sustaining populations on Conserved Lands to increase resilience to environmental and demographic stochasticity, maintain genetic diversity, and improve chances of persistence over the long term (>100 years) in chaparral and coastal sage scrub vegetation communities.

For the 2017–2021 planning cycle, the management and monitoring approach is to inspect chaparral nolina occurrence(s) on Conserved Lands (see Table of Occurrences) using the regional IMG monitoring protocol to record abundance and collect habitat and threat covariate data to determine management needs. Any necessary routine management actions should be conducted depending on what was identified through the 2016 and subsequent IMG monitoring and using BMPs with precautions to do no harm.

For details and the most up-to-date goals, objectives, and actions, go to the MSP Portal Chaparral Nolina summary page: [https://portal.sdmmp.com/view\\_species.php?taxaid=507567](https://portal.sdmmp.com/view_species.php?taxaid=507567)

### Chaparral Nolina References

CCH (Consortium of California Herbaria). 2013. <http://ucjeps.berkeley.edu/consortium/>. Accessed 2013.

CCH. 2017. Consortium of California Herbaria. <http://ucjeps.berkeley.edu/consortium/>. Accessed 2017.

CNPS (California Native Plant Society). 2011. Rare Plant Program. *Inventory of Rare and Endangered Plants* (online edition, v8-02). California Native Plant Society, Sacramento, CA. <http://www.rareplants.cnps.org>.

Hess, William J., and James C. Dice. 1995. *Nolina cismontana* (Nolinaceae), A New Species Name for an Old Taxon. *Novon* 5:162–164.

Reiser, C. H. 1994. *Rare Plants of San Diego County*. Imperial Beach, CA.

SANBIOS. 2013. Sensitive Species Sightings Geodatabase.

SANBIOS. 2015. Sensitive Species Sightings Geodatabase.

SDNHM (San Diego Natural History Museum). 2013. *San Diego County Plant Atlas*. <http://www.sdnhm.org/science/botany/projects>. Accessed 2013.

SDNHM. 2017. San Diego County Plant Atlas. <http://www.sdnhm.org/science/botany/projects>. Accessed 2017.

## 1.27 Dehesa Nolina (*Nolina interrata*) – Category SO

### Management Units wi0074h Known Occurrences

Dehesa nolina is a perennial herb that occurs on dry, stony slopes composed of gabbro-derived soils in chaparral and coastal scrub communities in southern San Diego County and Baja California, Mexico. There are 6 conserved populations of Dehesa nolina in MU3 (see Table of Occurrences and online map: <http://arcg.is/2hIOiN3>), and three known populations in Baja California (CBI 2015). Populations range from large to small and are subject to varying types and levels of threats as summarized below.

**Conservation Biology Institute** Prepared a conservation vision plan for Dehesa nolina in 2015 (CBI 2015). The conservation vision included detailed surveys to evaluate status and threats for all known occurrences on Conserved Lands in San Diego County, prioritized management actions by population, and identified survey and research needs.

### Management Categorization Rationale

Dehesa nolina should be managed as a Species Management Focus Category SO Species because persistence of 1 or more significant occurrences in the MSPA is at high risk of loss without immediate management action above and beyond that of daily maintenance activities (see Vol 1., Table 2-4) and because management of coastal sage scrub or chaparral habitat alone will not ensure its persistence. Factors contributing to this status include a highly limited range in MU3 and Baja California, vulnerability to catastrophic disturbance, and soil endemism. A primary threat to Dehesa nolina at both the regional and preserve levels appears to be purple false brome (*Brachypodium distachyon*), a nonnative grass that poses a particular threat in grassland and disturbed coastal sage scrub habitats (CBI 2012; CBI et al. 2012). Additional threats include potentially low genetic diversity due to small population size, habitat fragmentation, altered fire regime, nitrogen deposition and disturbance from recreation including legal and illegal trails and off-highway vehicle activity. Extensive flower predation by beetles has been observed as a potential threat although it is unknown whether this is a cyclic event or a threat of serious magnitude.

## Management and Monitoring Approach

The overarching goal for *Dehesa nolina* is to maintain or enhance existing occurrences and establish new occurrences, as needed, to ensure multiple conserved occurrences with self-sustaining populations to increase resilience to environmental and demographic stochasticity, maintain genetic diversity, and ensure persistence over the long term (>100 years) in chaparral vegetation communities.

For the 2017–2021 planning cycle, the management and monitoring approach for *Dehesa nolina* is to:

- (1) Inspect conserved occurrences every 3 years starting in 2019 to document abundance, record threats, and identify needed management actions. Implement routine management as determined during monitoring.
- (2) Refine BMPs based on the results of ongoing management experiments.
- (3) Use occurrence status and threat data and BMPs to develop a section for *Dehesa nolina* in the MSP Rare Plant Management Plan that prioritizes management actions. Implement the highest-priority management actions for *Dehesa nolina*.
- (4) Initiate preparation of a section for *Dehesa nolina* in the MSP Seed Collection, Banking, and Bulking Plan that directs seed collection in the MSPA to ensure representation of different occurrences in the seed bank, provide propagules to preserve genetic diversity, support habitat restoration, and rescue occurrences in case of catastrophic disturbance. Initiate *Dehesa nolina* seed banking and bulking.

For details and the most up-to-date goals, objectives, and actions, go to the MSP Portal *Dehesa Nolina* summary page:  
[http://portal.sdmmp.com/view\\_species.php?taxaid=42992](http://portal.sdmmp.com/view_species.php?taxaid=42992)

## Dehesa Nolina References

CBI (Conservation Biology Institute). 2012. *Covered and Invasive Species Management: Crestridge Ecological Reserve and South Crest Properties. Tasks 1–4: Covered Species Mapping, Invasive Species Mapping, Invasive*

*Plant Control, and Early Detection Plan.* Prepared for San Diego Association of Governments, San Diego, CA. Contract no. 5001586. June.

CBI. 2015. *Conservation Vision and Management Strategy Dehesa Nolina (Nolina interrata). San Diego County, California.* Prepared for San Diego Association of Governments

CBI, Dendra Inc., and Cal-IPC, 2012. *Management Priorities for Invasive Non-Native Plants A Strategy for Regional Implementation, San Diego, California.* San Diego, CA.

Environmental Mitigation Program Grant 5001763. April 2015.

## **1.28 California Orcutt Grass (*Orcuttia californica*) – Category SL**

### **Management Units with Known Occurrences**

California Orcutt grass is currently known from Ventura County to northern Baja California, Mexico (CNPS 2016), with extant populations in Ventura, Los Angeles, Orange, western Riverside, and San Diego Counties (USFWS 2011). California Orcutt grass is an obligate vernal pool species closely associated with deep vernal pools in clay soils with an impervious subsurface layer and longer inundation periods (Bauder et al. 1998). The species is specifically adapted to survive in vernal wet conditions due to the presence of aerenchyma tissue for submerged gas exchange called Crassulacean Acid Metabolism (CAM) photosynthesis (USFWS 2011). Seeds germinate in the saturated and/or submerged soils in vernal pools after a period of anaerobic conditions followed by exposure due to drying (Bauder et al. 1998).

In San Diego, California Orcutt grass is known from 1 vernal pool in the City of Carlsbad (MU6), 3 occurrences on MCAS Miramar (MU4), and 4 pool complexes on Otay Mesa (MU3) (Bauder et al. 1998; MSP-MOM 2014).

### **Management Categorization Rationale**

California Orcutt grass should be managed as a Species Management Focus Category SL Species due to a moderate risk of loss from Conserved Lands in the MSPA and because managing vernal pool vegetation alone will not ensure persistence of the species (see Vol. 1, Table 2-4). This species is vulnerable to loss from the MSPA because of its limited distribution in 2 MUs with only 2 occurrences in the MSPA (see Table of Occurrences or online map: <http://arcg.is/2kFKziT>). The species was listed as endangered in 1993 (USFWS 1993).

California Orcutt grass is threatened by urban and agricultural development (including mowing or plowing), ORV use (some ORV damage may also occur in the course of legitimate activities including fire-fighting, security patrols, and military maneuvers), habitat trampling associated with humans and/or livestock, drainage and/or watershed alterations, military activities, and the invasion of nonnative species (USFWS 1993). Habitat loss from urbanization and agricultural development continues to impact *O. californica* and will not likely be reduced until more private lands, which support the species, are conserved (USFWS 2011).



## Management and Monitoring Approach

The overarching goal for California Orcutt grass is to maintain or enhance existing occurrences to ensure multiple conserved occurrences with self-sustaining populations to increase resilience to environmental and demographic stochasticity, maintain genetic diversity, and ensure persistence over the long term (>100 years) in vernal pool vegetation communities.

For the 2017–2021 planning cycle, the management and monitoring approach for California Orcutt grass is to conduct annual surveys for California Orcutt grass in occupied, historically occupied, and potentially suitable vernal pools to determine cover classes in each basin and cover of each nonnative species using a standardized protocol as defined in the Vernal Pool Habitat Conservation Plan (City of San Diego 2015). Nonnative cover classes will be combined to determine if management triggers for Level 1, 2, or 3 management are met. Management recommendations will be made, noting individual nonnative species that pose a threat to direct specific management actions. Management actions will be implemented annually as part of the general vernal pool habitat management objectives for different management levels (ML1, ML2, ML3).

For details and the most up-to-date goals, objectives, and actions, go to the MSP Portal California Orcutt grass summary page: [https://portal.sdmmp.com/view\\_species.php?taxaid=41970](https://portal.sdmmp.com/view_species.php?taxaid=41970)

## California Orcutt Grass References

Bauder, E., A. Kreager, and S. McMillan. 1998. *Vernal Pools of Southern California Recovery Plan*.

City of San Diego. 2015. *Vernal Pool Habitat Conservation Plan (VPHCP) Preliminary Draft*. San Diego, CA.

CNPS (California Native Plant Society). 2016. Inventory of Rare and Endangered Plants (Online Edition, v8-02). <http://www.rareplants.cnps.org>.

MSP-MOM. 2014. *Management Strategic Plan Master Occurrence Matrix*.

USFWS (U.S. Fish and Wildlife Service). 1993. *50 CFR Part 17: Endangered and Threatened Wildlife and Plants: Revised Endangered Status, Revised Critical*

*Habitat Designation, and Taxonomic Revision for Federal Register 58:41384-41392.*

USFWS. 2011. *Orcuttia Californica (California Orcutt Grass) 5-Year Review: Summary and Evaluation.*

## **1.29 Gander's Ragwort (*Packera ganderi*) – Category SO**

### **Management Units with Known Occurrences**

Gander's ragwort is endemic to San Diego and Riverside Counties (Reiser 1994). It is a rare perennial herb that inhabits the understory of chamise chaparral, often in gabbroic soils. Gander's ragwort occurs at 8 locations on Conserved Lands within the MSPA (see Occurrence Table or online map: <http://arcg.is/2kJFPsL>). The species is mainly found in MUs 3 and 4, though occurrences have been found in MUs 10 and 11 in Cleveland National Forest, unconserved lands, and private land (CDFW 2013; SDNHM 2017). The occurrences in Barber Mountain and Iron Mountain are small, with populations of <500 individuals. The McGinty Mountain occurrence consists of plants at 5 locations in fairly close proximity on 2 preserves and is considered a CNDDB occurrence (CDFW 2013). The current status of an occurrence recorded in the 1990s on Conserved Lands at O'Neal Canyon is unknown (County San Diego 2007). There are 2 old records (mid-1990s) in MU8 on private lands that are not conserved.

### **Management Categorization Rationale**

Gander's ragwort should be managed as a Species Management Focus Category SO Species due to a moderate risk of loss from Conserved Lands in the MSPA and because managing chaparral habitats alone will not ensure its persistence (see Vol. 1, Table 2-4). Gander's ragwort is at moderate risk of loss from the MSPA as it is a perennial herb with mostly small occurrences and few moderate occurrences on Conserved Lands that are isolated and vulnerable to demographic stochasticity and loss of genetic diversity. There is an indication that 1 of the occurrences is much smaller now than in the late 1980s.

### **Management and Monitoring Approach**

The overarching goal for Gander's ragwort is to maintain or enhance occurrences to ensure multiple conserved occurrences with self-sustaining populations to increase resilience to environmental and demographic stochasticity, maintain genetic diversity, and ensure persistence over the long term (>100 years) in chaparral vegetation communities.

For the 2017–2021 planning cycle, the management and monitoring approach for Gander's ragwort is to inspect Gander's ragwort occurrences on Conserved Lands

(see Table of Occurrence) every 3 years using the regional rare plant IMG monitoring protocol to record abundance and collect habitat and threats covariate data to determine management needs and conduct routine management actions identified through the IMG monitoring in 2016 and implement management as needed using BMPs with precautions to do no harm.

For details and the most up-to-date goals, objectives, and actions, go to the MSP Portal Gander's Ragwort summary page:  
[https://portal.sdmmp.com/view\\_species.php?taxaid=565357](https://portal.sdmmp.com/view_species.php?taxaid=565357)

### **Gander's Ragwort References**

CDFW (California Department of Fish and Wildlife). 2013. California Natural Diversity Database. Species occurrences shapefile. Accessed 2013.

County of San Diego. 2007. *County of San Diego MSCP Monitoring Summary Report, January 1998–June 2007*. Prepared for the U.S. Fish and Wildlife Service and California Department of Fish and Game.

SDNHM (San Diego Natural History Museum). 2017. *San Diego County Plant Atlas*. <http://www.sdnhm.org/science/botany/projects> Accessed 2017.

Reiser, C. H. 1994. *Rare Plants of San Diego County*. Imperial Beach, CA.

### **1.30 Otay Mesa Mint (*Pogogyne nudiuscula*) – Category SL**

#### **Management Units with Known Occurrences**

Otay mesa mint is restricted to vernal pools on Otay Mesa in southern San Diego County, California (USFWS 1993, 2010). The species was historically known across the international border where the Tijuana International Airport is now located; however, no Tijuana populations are known to exist today. Otay mesa mint is an obligate vernal pool species occurring only on Stockpen soils in southern coastal mesa vernal pools (Bauder et al. 1998) at an elevation of 90–250 meters (CNPS 2016). Otay mesa mint is considered an obligate wetland species but is more tolerant of the ephemeral inundation of vernal pool habitat than true wetland plants (USFWS 2010).

Otay mesa mint blooms from May or June through early July when water is absent from vernal pools, completing its life cycle in the spring rather than in the summer through winter months (Munz 1974; USFWS 2010). The link between the onset of germination and the temporal conditions needed for vernal pool inundation, temperature, and moisture are critical to germination, maturation, flowering, and fruiting (USFWS 2010).

Within the MSPA, Otay mesa mint is found in MU3 at 3 locations on Otay Mesa: Otay Mesa West, Otay Mesa East, and Otay Mesa Northeast (USFWS 2010; MSP-MOM 2014).

#### **Management Categorization Rationale**

Otay mesa mint should be managed as a Species Management Focus Category SL Species due to a high risk of loss from Conserved Lands in the MSPA and because managing the general vegetation community alone will not ensure persistence of the species (see Vol. 1, Table 2-4). Otay mesa mint was listed as a federally endangered species in 1993 (USFWS 1993).

Otay mesa mint has specific habitat requirements (e.g., soil type/Stockpen soils, water depth); therefore, habitat degradation and alteration of the surrounding habitat will likely result in a population decline or even local extirpation. Habitat loss and degradation can occur due to filling, grading, discing, leveling, urban and agricultural development, road projects, grazing, ORV use, trampling, invasion from weedy nonnative plants, trash dumping, soil compaction, erosion, drought,

habitat fragmentation and isolation of vernal pool systems and complexes, and alteration of the watershed (USFWS 1993, 2010; Bauder et al. 1998). Destruction of watersheds and disruption of hydrological systems can create further impacts by creating barriers to dispersal, such that pollination and reproductive output may be inhibited (Bauder 1987; Schiller et al. 2000). Occurrences on Otay Mesa are in areas that experience a high volume of foot traffic between Mexico and the United States. Increased border security on Otay Mesa may threaten vernal pool habitat along the international border (Bauder 1987).

### **Management and Monitoring Approach**

The overarching goal for Otay mesa mint is to protect, enhance, and restore occupied and historically occupied habitat to create self-sustaining populations that are resilient to environmental stochasticity and threats, such as altered hydrology, climate change, and invasive plants, and will be likely to persist over the long term (>100 years).

For the planning cycle of 2017–2021, the management and monitoring approach is to conduct annual surveys in occupied, historically occupied, and potentially suitable vernal pools to determine cover classes in each basin and cover of each nonnative species using a standardized protocol as defined in the Vernal Pool Management and Monitoring Plan (City of San Diego 2015). Nonnative cover classes will be combined to determine if management triggers for Level 1, 2, or 3 management are met. Management recommendations will be made, noting individual nonnative species that pose a threat to direct specific management actions. Management actions should be implemented annually as part of the general vernal pool habitat management objectives for different management levels (ML1, ML2, ML3).

For details and the most up-to-date goals, objectives, and actions, go to the MSP Portal Otay Mesa Mint summary page: [https://portal.sdmmp.com/view\\_species.php?taxaid=32643](https://portal.sdmmp.com/view_species.php?taxaid=32643).

### **Otay Mesa Mint References**

Bauder, E., A. Kreager, and S. McMillan. 1998. *Vernal Pools of Southern California Recovery Plan*.

- Bauder, E. T. 1987. Threats to San Diego Vernal Pools and Case Study in Altered Pool Hydrology. In *Conservation and Management of Rare and Endangered Plants. Proceedings from a Conference of the California Native Plant Society*, edited by T. S. Elias, pp. 209–213.
- City of San Diego. 2015. *Vernal Pool Habitat Conservation Plan (VPHCP) Preliminary Draft*. San Diego, CA.
- CNPS (California Native Plant Society). 2016. *Inventory of Rare and Endangered Plants* (Online Edition, v8-02). <http://www.rareplants.cnps.org>.
- MSP-MOM. 2014. *Management Strategic Plan Master Occurrence Matrix*.
- Munz, P. A. 1974. *A Flora of Southern California*. Berkeley, California: University of California Press.
- Schiller, J. R., P. H. Zedler, and C. H. Black. 2000. The Effect of Density-Dependent Insect Visits, Flowering Phenology, and Plant Size on Seed Set of the Endangered Vernal Pool Plant *Pogogyne Abramsii* (Lamiaceae) in Natural Compared to Created Vernal Pools. *Wetlands* 20(2):386–396. doi:10.1672/0277-5212(2000)020[0386:TEODDI]2.0.CO;2.
- USFWS (U.S. Fish and Wildlife Service). 1993. *50 CFR Part 17: Endangered and Threatened Wildlife and Plants: Revised Endangered Status, Revised Critical Habitat Designation, and Taxonomic Revision for Federal Register 58:41384-41392*.
- USFWS. 2010. *Pogogyne Nudiuscula (Otay Mesa Mint) 5-Year Review: Summary and Evaluation*. Carlsbad Fish and Wildlife Office. Carlsbad, California.

### **1.31 Small-leaved Rose (*Rosa minutifolia*) – Category SS**

#### **Management Units with Known Occurrences**

Small-leaved rose is distributed primarily along mesas and canyons near the coast in Baja California, Mexico (Reiser 1994). There is a transplanted occurrence and 1 potentially extant natural occurrence in MU3 (see Table of Occurrences and online map). In 1998, a single rose bush (the only occurrence in the United States) was salvaged and divided into smaller plants and then transplanted to Conserved Lands near Denner Canyon (RECON 2005). From this original transplantation of 245 plants, there are currently 203 cloned individuals at the former Cal Terraces site (City of San Diego 2012). Cuttings were also collected from the plant and rooted and grown at a commercial nursery and then approximately 1,000 of these cuttings were also planted within open space areas in the adjacent development (Scheid and MacAller 2005). In 2015, the City of San Diego monitored 9 of these shrubs in a fuel modification zone on Conserved Lands (City of San Diego 2015). During 2009 baseline surveys of the Otay Ranch Preserve's San Ysidro parcel, 2 rose bushes were reported (Dudek and Associates 2010). However, these plants have not been detected during subsequent surveys (M. Doderer, pers. comm.).

#### **Management Categorization Rationale**

Small-leaved rose is designated as a Species Management Focus Category SS Species due to a moderate risk of loss from Conserved Lands in the MSPA. Factors contributing to this risk of loss include a very limited range in southwestern San Diego County with restriction to 1 MU in the MSPA and only 1 confirmed occurrence composed of transplantings from a single clone. This species is not ranked as a Category SL Species as it is long-lived and reproduces vegetatively, and occurrences appear stable with a low threat risk over the short term.

#### **Management and Monitoring Approach**

The overarching goal for small-leaved rose is to maintain or enhance existing small-leaved rose occurrences with self-sustaining populations to increase resilience to environmental and demographic stochasticity, maintain genetic diversity, and improve chances of persistence over the long term (>100 years) in chaparral and coastal sage scrub vegetation communities.



For the planning cycle of 2017–2021, the management and monitoring approach is to:

- (1) Inspect small-leaved rose occurrences on Conserved Lands (see Table of Occurrences Table) using the regional rare plant IMG monitoring protocol to record abundance and collect habitat and threats covariate data to determine management needs.
- (2) Conduct routine management actions as identified through the IMG monitoring conducted in 2016 and 2021 at the small-leaved rose occurrences on Conserved Lands (see Table of Occurrences). Depending on the type and level of threat, management should be conducted as needed, not necessarily every year, and using BMPs with precautions to do no harm.

For details and the most up-to-date goals, objectives, and actions, go to the MSP Portal Small-leaved Rose summary page: [https://portal.sdmmp.com/view\\_species.php?taxaid=504824](https://portal.sdmmp.com/view_species.php?taxaid=504824)

### **Small-leaved Rose References**

City of San Diego. 2012. City of San Diego Rare Plant Monitoring Data.

City of San Diego. 2015. City of San Diego Rare Plant Monitoring Data. [https://www.sandiego.gov/sites/default/files/9\\_mscp\\_rare\\_plant\\_monitoring\\_report\\_2015l.pdf](https://www.sandiego.gov/sites/default/files/9_mscp_rare_plant_monitoring_report_2015l.pdf).

Dudek and Associates. 2010. *Baseline Biodiversity Survey for the Otay Ranch Preserve*. Prepared for the County of San Diego.

RECON. 2005. Year 5 Final Mitigation Monitoring Report for the Small-leaved Rose Translocation Project on the Ocean View Hill Property (Formerly California Terraces and Otay Corporate Center). Prepared for Pardee Homes. January 6, 2005.

Reiser, C. H. 1994. *Rare Plants of San Diego County*. Imperial Beach, CA.

Scheid, Gerald A., and Jennifer J. McAller. 2005. *Year 5 Final Mitigation Monitoring Report for the Small-leaved Rose Translocation Project on the Ocean View*

*Hills Property (Formerly California Terraces and Otay Corporate Center.  
Prepared for Pardee Homes.*

### **1.32 Parry's Tetracoccus (*Tetracoccus dioicus*) – Category SS**

#### **Management Units with Known Occurrences**

Parry's tetracoccus is a shrub endemic to Orange, Riverside, and San Diego Counties, and northern Baja California, Mexico (Reiser 1994). This species is found in chamise chaparral vegetation with moderately deep canopy cover. It is restricted to Las Posas soils and uncommon gabbro derived soils (Reiser 2001).

There are 8 recent occurrences within the MSPA in MUs 3 and 8 (see Table of Occurrences). Parry's tetracoccus occurs in MU3 at South Crest Properties, McGinty Mountain (2 occurrences), and Sycuan Peak. There is 1 large occurrence with thousands of plants in MU8 in the northern San Marcos Mountains that is partially on lands protected by an easement. Other locations in MU8 include Monserate Mountain Preserve south of Rainbow, Wilderness Gardens Preserve, and the southern end of the Miriam Mountains in Escondido Open Space. Most of this latter occurrence of 50 plants is mapped on private lands and the number of plants on Conserved Lands is unknown. In 1997, this species was mapped along trails and the road to Wilderness Gardens Preserve and were detected in the AECOM 2015 surveys (CDFW 2012). There are 7 occurrences on private lands in MUs 4 and 8 (see online map: <http://arcg.is/2iBHyPW>).

#### **Management Categorization Rationale**

Parry's tetracoccus should be managed as a Species Management Focus Category SS Species due to a moderate risk of loss from Conserved Lands in the MSPA and because managing chamise chaparral vegetation alone will not ensure its persistence (see Vol. 1, Table 2-4). Parry's tetracoccus is at moderate risk of loss from the MSPA because only 8 occurrences are conserved in the MSPA, with most small or unknown in size (see Vol. 3, App. 1, Species Profiles). Although it is a rare shrub with limited distribution, it does not appear to face a high degree of immediate threat and thus is categorized as an SS species.

This species is a fire follower and could be impacted by an altered fire regime, either from too short or too long fire return intervals (County of San Diego 2010; CBI et al. 2012). Invasive nonnative plants and recreational activities can also adversely affect occurrences (CBI et al. 2012). Additionally, this species is particularly susceptible to orchard expansion where chaparral is cleared for avocado or citrus (Reiser 1994).

## Management and Monitoring Approach

The overarching goal for Parry's tetracoccus is to maintain or enhance existing occurrences to ensure multiple conserved occurrences with self-sustaining populations to increase resilience to environmental and demographic stochasticity, maintain genetic diversity, and ensure persistence over the long term (>100 years) in chaparral and coastal sage scrub vegetation communities.

For the planning cycle of 2017–2021, the management and monitoring approach is to:

- (1) Begin field research into soils and habitat relationships and conduct habitat suitability and climate change modeling for Parry's tetracoccus and other edaphic endemic plants. This will lead to a better understanding of habitat requirements and to identifying and prioritizing geographic areas important for connectivity, restoration, and range shifts due to climate change and other threats.
- (2) Inspect Parry's tetracoccus occurrences on Conserved Lands (see Table of Occurrences) using the regional rare plant IMG monitoring protocol to record abundance and collect habitat and threats covariate data to determine management needs.
- (3) Conduct routine management actions identified through the IMG monitoring at Parry's tetracoccus occurrences on Conserved Lands (see Table of Occurrences). Depending on the type and level of threat, management should be conducted as needed, not necessarily every year, and using BMPs with precautions to do no harm.

For details and the most up-to-date goals, objectives, and actions, go to the MSP Portal Parry's tetracoccus summary page: [https://portal.sdmmp.com/view\\_species.php?taxaid=28420](https://portal.sdmmp.com/view_species.php?taxaid=28420).

## Parry's Tetracoccus References

CBI (Conservation Biology Institute), California Invasive Plant Council, and Dendra 2012. *Management Priorities for Invasive Non-Native Plants: A Strategy for Regional Implementation, San Diego County, California*. Prepared by CBI,

California Invasive Plant Council, and Dendra for the San Diego Association of Governments. Contract No. 5001322.

CDFW (California Department of Fish and Wildlife). 2012. California Natural Diversity Database. Species occurrences shapefile, accessed 2012 and 2013.

County of San Diego. 2010. *Draft North County Multiple Species Conservation Plan Conservation Analysis*.

Reiser, C. H. 1994. *Rare Plants of San Diego County*. Imperial Beach, CA.

Reiser, C. H. 2001. *Rare Plants of San Diego County*. San Diego, CA: Aquifer Press.

This page intentionally left blank.

## 2.0 INVERTEBRATES - SL, SO, SS

### 2.1 San Diego Fairy Shrimp (*Branchinecta sandiegonensis*) – Category SL

#### Management Units with Known Occurrences

San Diego fairy shrimp are endemic to southern California and are restricted to vernal pools and other nonvegetated, temporary (i.e., containing water a short time) basins in coastal southern California and northwestern Baja California, Mexico (USFWS 2008). San Diego fairy shrimp are vernal pool (seasonal depressional wetlands) habitat specialists, found in small, shallow vernal pools 5–30 centimeters (2–12 inches) deep with a temperature range of 10–20 degrees Centigrade (USFWS 1997). They are occasionally found in ditches and road ruts that support suitable conditions (USFWS 2008). San Diego fairy shrimp are usually observed from January through March when seasonal rainfall fills vernal pools and initiates cyst (egg) hatching (Hathaway and Simovich 1996).

Within the MSPA, San Diego fairy shrimp is known from vernal pools and vernal pool complexes in MUs 1, 2, 3, 4, 5, and 6 in Tijuana Slough National Wildlife Reserve, Imperial Beach, Kearny Mesa, Chollas Heights, Sweetwater Reservoir, Marron Valley, Otay Mesa, Mission trails Regional Park, Santee, Poway, Ramona, Del Mar Mesa, Lopez Ridge, Mira Mesa, Carlsbad, and San Marcos (MSP-MOM 2014). They are also known from vernal pools on MCAS Miramar, which supports the largest contiguous block of habitat and highest number of occupied vernal pools within the range of the San Diego fairy shrimp (39 complexes; over 1,899 pools) (USFWS 2008). It is important to note that surveys may miss observing and collecting adults because not all vernal pools fill in a given year; pools may not fill long enough for dormant cysts to hatch; and, in any given pool that has ponded water long enough to hatch San Diego fairy shrimp cysts, only a small percentage of the cyst bank hatches (i.e., bet-hedging; Simovich and Hathaway 1997; Philippi et al. 2001).

#### Management Categorization Rationale

San Diego fairy shrimp should be managed as a Species Management Focus Category SL Species due to a very restricted distribution in the MSPA and threats from invasive plants, and because managing the general vegetation community

alone will not ensure persistence of the species. Management should focus on enhancing vernal pool habitat. In 1997, the San Diego fairy shrimp was listed as an endangered species (USFWS 1997).

The loss and modification of vernal pool habitat continues to be a significant threat to the San Diego fairy shrimp, especially in areas where urbanization is expected to expand (USFWS 2008). Destruction of watersheds and disruption of hydrological systems can create further impacts by creating barriers to dispersal, such that reproductive output may be inhibited (Bauder 1987). Vehicles may negatively affect fairy shrimp by disrupting pool hydrology and chemistry, crushing cysts, displacing adults or cysts to unsuitable locations, or creating conditions favorable for invasion of nonnative plants that degrade pool habitat (Hathaway et al. 1996). Destruction of watersheds and disruption of hydrological systems can create further impacts by creating barriers to dispersal, such that reproductive output may be inhibited (Bauder 1987). Other threats include loss of habitat and degradation due to filling, grading, discing, and leveling; urban and agricultural development; road projects; grazing; ORV use; trampling; invasion from weedy nonnative plants; trash dumping; soil compaction; erosion; drought; habitat fragmentation and isolation of vernal pool systems and complexes; and alteration of the watershed (USFWS 1997).

### **Management and Monitoring Approach**

The overarching goal for San Diego fairy shrimp is to protect, enhance, and restore occupied and historically occupied habitat to create resilient, self-sustaining populations that provide for persistence over the long term (>100 years).

For the planning cycle of 2017–2021, the management and monitoring approach is to conduct annual qualitative surveys during the wet season to determine the presence of San Diego fairy shrimp in vernal pools on Conserved Lands. Every 3 years conduct dry season quantitative cyst soil sampling at a rotating panel of vernal pools to determine the density of San Diego fairy shrimp cysts, as identified by genetic analysis. Determine whether the pools fall into Level 1 (stable), Level 2 (enhancement), or Level 3 (restoration) management categories based on the presence of shrimp among pools in each complex. Track increases or declines in cyst densities over 3 monitoring years to determine if movement is triggered between management categories as identified in the VPMMP. If there is sufficient decline in San Diego fairy shrimp cyst density to trigger an increase in management levels as



identified in the VPMMP, then more intensive monitoring is required to determine topographic or hydrologic disturbances as described in the VPMMP.

For details and the most up-to-date goals, objectives, and actions, go to the MSP Portal San Diego Fairy Shrimp summary page: [https://portal.sdmmp.com/view\\_species.php?taxaid=624043](https://portal.sdmmp.com/view_species.php?taxaid=624043).

### San Diego Fairy Shrimp References

Bauder, E. T. 1987. Threats to San Diego Vernal Pools and Case Study in Altered Pool Hydrology. In *Conservation and Management of Rare and Endangered Plants. Proceedings from a Conference of the California Native Plant Society*, edited by T. S. Elias, 209–213.

Hathaway, S. A., D. P. Sheehan, and M. A. Simovich. 1996. Vulnerability of Branchiopod Cysts to Crushing. *Journal of Crustacean Biology* 16(3):448–452. <http://www.jstor.org/stable/1548734>.

Hathaway, S. A., and M. A. Simovich. 1996. Factors Affecting the Distribution and Co-Occurrence of Two Southern Californian Agnostracans (Branchiopoda), *Branchinecta Sandiegoensis* and *Streptocephalus Woottoni*. *Journal of Crustacean Biology* 16(4):669–677.

MSP-MOM. 2014. *Management Strategic Plan Master Occurrence Matrix*.

Philippi, T. E., M. A. Simovich, E. T. Bauder, and J. A. Moorad. 2001. Habitat Ephemerality and Hatching Fractions of a Diapausing Anostracan (Crustacea: Branchiopoda). *Israel Journal of Zoology* 47:387–396. DOI:10.1560/LU8G-9HVP-YR80-XCL0.

Simovich, M. A., and S. A. Hathaway. 1997. Diversified Bet-Hedging as a Reproductive Strategy of Some Ephemeral Pool Anostracans (Branchiopoda). *Journal of Crustacean Biology* 17(1):38–44. DOI:10.2307/1549460.

USFWS (U.S. Fish and Wildlife Service). 1997. Determination of Endangered Status for the San Diego Fairy Shrimp. *Federal Register* Vol. 62, No. 22: 4925-4939.

USFWS. 2008. *San Diego Fairy Shrimp (Branchinecta Sandiegoensis)*. Carlsbad, California.

## 2.2 Quino Checkerspot Butterfly (*Euphydryas editha quino*) – Category SL

### Management Units with Known Occurrences

Quino checkerspot butterfly was historically one of the most widespread and abundant butterfly species in coastal southern California, distributed from Los Angeles County south into northern Baja California, Mexico, and east into the inland valleys south of the Tehachapi Mountains (Mattoni et al. 1997; USFWS 2003). The species began declining in the 1920s, with steep declines in the 1970s, and is now restricted to several localities in San Diego and Riverside Counties and northern Baja California. Quino checkerspot occur in open shrubland and native grassland that support larval host plants such as dwarf plantain (*Plantago erecta*) and white snapdragon (*Antirrhinum coulterianum*), and diverse nectar sources for adults.

USFWS designated the following Recovery Units for Quino Checkerspot in San Diego County in 2003: South Riverside/North San Diego Recovery Unit, Southwest San Diego Recovery Unit, and Southeast San Diego Recovery Unit (USFWS 2003). The Southwest San Diego Recovery Unit and the South Riverside/North San Diego Recovery Unit occur within the MSPA. Each Recovery Unit contains identified occurrence complexes defined as estimated occupied areas based on habitat within 1 kilometer (0.6 mile) of recent [not defined] Quino checkerspot detections (USFWS 2003). Quino often display a metapopulation structure, so it is important to conserve temporarily unoccupied habitat for population resilience (USFWS 2009).

Known locations of Quino checkerspot in San Diego County are best compiled in SANBIOS (2012) and are derived from surveys conducted by consultants, butterfly enthusiasts, and agency personnel. Annual monitoring of Quino checkerspot occurrences is conducted by USFWS at reference sites in Riverside and San Diego Counties to assess host plant phenology, presence and growth of larvae, and the timing of the adult flight season. However, surveys are not conducted regularly in San Diego County and no county-wide occurrence monitoring data exists for this species. Quino checkerspot occurrences are known to fluctuate widely from year to year (USFWS 2003). Therefore, size of occurrences is not provided in the MSP tables.

Quino checkerspot has been detected in MUs 2, 3, 4, 6, 9, and 11 (see Table of Occurrences and online map: <http://arcg.is/2iBlmnQ>). MU2 has only one detection, from 2008, on Mission Trails Regional Park. "From the perspective of judging

whether an occurrence has been extirpated, it is important to know that a normally robust occurrence may generate no adults at all in a given year if poor environmental conditions preclude an adult flight period" (USFWS 2003).

Quino checkerspot has been detected at numerous locations in MU3 in the Southwest San Diego Recovery Unit (see Table of Occurrences). This MU contains a critical movement corridor in the Otay Lakes/Rancho Jamul occurrence complex area (USFWS 2003, 2009), which is thought to connect occurrences between Mexico to the south, San Vicente and Alpine to the north, and Dulzura to the east.

Quino checkerspot is also known to occur in MU4 at six preserves: Goodan Canyon and Sycamore Ranch Preserve, Mission Trails Regional Park, Monte Vista Ranch, San Vicente Open Space Preserve, San Vicente Reservoir Cornerstone Lands, and Sycamore Estates. In addition, the USFWS Recovery Plan and the USFWS 5-Year Review for *Euphydryas editha quino* mention occurrences found in the Miramar area. Populations within MU4 fall into the "Possible Future Central San Diego Recovery Unit" and are considered important for the recovery of Quino checkerspot (USFWS 2003).

The most recent record of Quino checkerspot in MU6 is from 1982 at Lake Hodges. Part of the South Riverside/North San Diego Recovery Unit (USFWS 2003) falls within MU9. There are several recent occurrences of Quino in MU9 on BLM, Cleveland National Forest, and Vista Irrigation lands.

### **Management Categorization Rationale**

Quino checkerspot should be managed as a Species Management Focus Category SL Species due to a high risk of loss from Conserved Lands in the MSPA and because managing the general vegetation community alone will not ensure persistence of the species (see Vol. 1, Table 2-4). The high risk of loss is due to the small number of existing occurrences, high annual fluctuation in occurrence sizes, low rate of dispersal, and high risk of threat (see Vol. 3, App. 1, Species Profiles).

The Quino checkerspot butterfly faces a number of threats to persistence including urbanization leading to habitat loss and fragmentation, invasive nonnative plants, altered fire regimes, and overgrazing (Mattoni et al. 1997; Longcore et al. 2003; USFWS 2003, 2009). Invasive plant species reduce bare ground important for larval insolation and reduce native species, resulting in a loss of host and nectaring plants. An altered fire regime may not only cause direct mortality; it can also

increase invasion of nonnative plants. Nitrogen deposition is also contributing to an increase in invasive annual grasses associated with the decline of this species.

Habitat fragmentation disrupts connectivity between occurrences such that there is a lack of recolonization following local extinction. Other threats include multiple years of drought causing high rates of larval mortality and occurrence extinctions. Quino checkerspot could be increasingly vulnerable to prolonged and intense droughts predicted by climate change models (Parmesan 1996; Preston et al. 2012). Due to a warming, drier climate, checkerspot butterflies have already experienced shifts north and up in elevation since the early 20th century, a pattern that could continue with climate change (Parmesan 1996). Other threats include direct mortality from roads and human use of preserves that cause trampling of larvae and host plants and compaction of soils.

### **Management and Monitoring Approach**

The overarching goal for Quino checkerspot is to protect, enhance, and restore occupied habitat and historically occupied habitat and the landscape connections between them to create resilient, self-sustaining populations that provide for persistence over the long term (>100 years).

For the planning cycle of 2017–2021, the management and monitoring approach is the following:

- (1) Develop habitat suitability models for Quino checkerspot, host plants, and nectaring plants under current and future climate change scenarios, and conduct fire risk modeling with different management scenarios to identify potential climate and fire refugia. The results of this modeling will be used to inform development of monitoring and management plans.
- (2) Develop a section for nectaring forbs and host plants in the MSP Seed Collection, Banking, and Bulking Plan to enhance and restore habitat and begin implementing the plan.
- (3) Develop an interim 5-year Quino Checkerspot Management Plan that focuses on habitat enhancement and restoration and fire management, and includes the information from the MSP Seed Collection, Banking, and Bulking Plan for Quino checkerspot, at known occupied and historically occupied sites. Implement highest-priority management actions for Quino

checkerspot on Conserved Lands and monitor effectiveness of implementation.

- (4) Prepare a long-term Quino checkerspot metapopulation monitoring plan to track population distribution, abundance, and phenology, and to assess habitats and threats at Quino checkerspot occurrences (see Table of Occurrences), historically occupied sites, and unoccupied high suitability sites across Conserved Lands in the MSPA.
- (5) Conduct pilot monitoring to evaluate monitoring methodology and sampling design and locations, and prepare recommendations for any adjustments to the monitoring plan
- (6) Support existing efforts by the wildlife agencies to collect eggs and captive rear larvae to use in reestablishing and augmenting wild populations; use results to finalize the Quino Checkerspot Management and Monitoring Plan. Support the wildlife agencies' efforts to translocate captive bred larvae to historically occupied habitat and monitor effectiveness of translocation.
- (7) Implement invasive plant control and other post-fire management actions as needed to ensure the recovery of Quino checkerspot at sites occupied within the last 10 years to facilitate habitat recovery, particularly forbs and host plants 3 years after wildfire events.
- (8) For at least the first 3 years following a wildfire, monitor recovery of Quino checkerspot occurrences and habitat affected by fire.
- (9) Finalize the management plan with results from the captive rearing and translocation projects and combine with the monitoring plan to create a comprehensive Quino Checkerspot Management and Monitoring Plan.

For details and the most up-to-date goals, objectives, and actions, go to the MSP Portal Quino Checkerspot Butterfly summary page: [https://portal.sdmmp.com/view\\_species.php?taxaid=779299](https://portal.sdmmp.com/view_species.php?taxaid=779299)

## Quino Checkerspot References

- Longcore, T., D. D. Murphy, D. H. Deutschman, R. Redak, and R. N. Fisher. 2003. *A Management and Monitoring Plan for Quino Checkerspot Butterfly (Euphydryas Editha Quino) and Its Habitats in San Diego County, Advisory Report to the County of San Diego*. San Diego, CA.
- Mattoni, R., G. F. Pratt, T. R. Longcore, J. F. Emmel, and J. N. George. 1997. The Endangered Quino Checkerspot Butterfly, *Euphydryas Editha Quino* (Lepidoptera : Nymphalidae). *Journal of Research on the Lepidoptera* 34:99–118.
- Parmesan, C. 1996. Climate and Species' Range. *Nature* 382:765–66. DOI10.1038/382765a0.
- Preston, K. L., R. A. Redak, M. F. Allen, and J. T. Rotenberry. 2012. Changing Distribution Patterns of an Endangered Butterfly: Linking Local Extinction Patterns and Variable Habitat Relationships. *Biological Conservation* 152. Elsevier Ltd: 280–90. DOI:10.1016/j.biocon.2012.03.011.
- SANBIOS. 2012. Sensitive Species Sightings Geodatabase. <http://catalog.opensandiego.org/opendata/resource/3118/sanbios-ecology/>.
- USFWS (U.S. Fish and Wildlife Service). 2003. *Recovery Plan for the Quino Checkerspot Butterfly (Euphydryas Editha Quino)*. Portland, OR.
- USFWS. 2009. *Quino Checkerspot Butterfly (Euphydryas Editha Quino) 5-Year Review Summary and Evaluation*. Carlsbad, California.

## 2.3 Harbison's Dun Skipper (*Euphyes vestris harbisoni*) – Category SL

### Management Units with Known Occurrences

The Harbison's dun skipper is a rare species with a limited distribution in San Diego County and southern Orange County (Marschalek and Deutschman 2015). A 2013–2014 survey estimated the current San Diego County distribution to include the foothills in northern and southern San Diego County, extreme western Riverside County, and southern Orange County. In July 2009, there was a confirmed, but unpublished, sighting in La Mission, Baja California (Faulkner and Klein 2012). Unlike other subspecies, the Harbison's dun skipper is found in chaparral or riparian areas that have narrow canyons or drainages. Oak woodland is a preferred vegetation community due to the balance of sun and shade. The host plant, San Diego sedge (*Carex spissa*) is found in habitats with moving water or dry ravines, and is unlikely to be found in areas with pools of standing water (Marschalek and Deutschman 2015).

Male skippers will patrol canyons, but never far from the host plant. Females will perch on the host plant basking in the sun. Harbison's dun skippers are attracted to nectar sources such as, morning glory (*Calystegia macrostegia tenuifolia*), red thistle (*Cirsium occidentale*), loosestrife (*Lythrum californicum*), and less frequently golden yarrow (*Eriophyllum confertiflorum*) and black mustard (*Brassica nigra*). There are 20 known species of nectar sources, nearly all of which have white, purple, or pink flowers (Marschalek and Deutschman 2016). The skipper is a generalist feeder with a preference for milkweeds and thistle (Marschalek and Deutschman 2015).

Harbison's dun skippers have been detected in MUs 3, 4, 5, 6, and 11 (see Table of Occurrences). The 2003 and 2007 wildfires likely caused local extirpations of the Harbison's dun skipper, leading to significant gaps around the Poway area (Marschalek and Deutschman 2016). The San Pasqual Academy site in MU5 experienced a wildfire that reduced the oak canopy, a necessary habitat component for sedge plants surviving dry conditions. After the 2016 survey, based on habitat conditions and observations, it appears that the skipper has been extirpated from this site (see online map: <http://arcg.is/2kTTLxw>).

## Management Categorization Rationale

Harbison's dun skipper should be managed as a Species Management Focus Category SL Species due to a high risk of loss from Conserved Lands in the MSPA (see Vol. 1, Table 2-4). The high risk of loss is due to the small number of existing occurrences, high annual fluctuation in occurrence sizes, low rate of dispersal, and high risk of threat (see Vol. 3, App. 1, Species Profiles).

The largest threat to the skipper comes from habitat loss, fragmentation, and decreased water quality (Faulkner and Klein 2012). Habitat loss and fragmentation can lead to reduced dispersal and gene flow, which is especially concerning in small populations like the Harbison's dun skipper (Marschalek and Deutschman 2015). Degradation of habitat can also occur from habitat alternations like bank stabilization and channelization via concrete channels. The loss of the inland riparian areas and drainages that this species requires is not well documented (Faulkner and Klein 2012). Additionally, these locations are often dumping grounds for trash, reducing water quality and diminishing the host plant's capacity to survive.

Additional threats come from wildfires, invasive plants, drought, the goldspotted oak borer, and grazing (Marschalek and Deutschman 2015). Fire can directly and indirectly impact the skipper. Fire followed by below-average rainfall could be problematic for the skipper since it can impede the ability of the San Diego sedge to regrow (Faulkner and Klein 2012). Fires can also lead to exotic and invasive plant species growth in riparian areas, such as giant cane (*Arundo* spp.) and cattails (*Typha* spp.), which could inhibit sedges from growing (Marschalek and Deutschman 2015). Drought threatens the skipper by making the leaves of the larval food plant dry and unusable, or by killing the plant. The goldspotted oak borer can have similar impacts on the skipper if an infected oak tree dies and the amount of shade on the understory sedge plants is reduced, thereby increasing water-stress of the plants.

In 1989, USFWS listed the Harbison's dun skipper as a Category 2 species in a notice of review (Marschalek and Deutschman 2016). A petition to list the Harbison's dun skipper was submitted in 1991. USFWS found that the petition did not include substantial information for listing (Marschalek and Deutschman 2015).



## Management and Monitoring Approach

The overarching goal for Harbison's dun skipper is to protect, enhance, and restore occupied habitat, historically occupied habitat, and the landscape connections between them to create resilient, self-sustaining populations that provide for persistence over the long term (>100 years).

For the planning cycle of 2017–2021, the management and monitoring approach is the following:

- (1) In conjunction with adult surveys and the marking study for Harbison's dun skipper (see Table of Occurrences), capture adult butterflies and collect nonlethal genetic samples (i.e., legs) to analyze population genetic structure, dispersal and connectivity between populations, and genetic diversity.
- (2) Conduct a marking study of adults during the flight season to determine connectivity within habitat patches in a watershed.
- (3) Develop habitat suitability models for Harbison's dun skipper, the host plant (San Diego sedge), and oak woodlands under current and future climate change scenarios, and conduct fire risk modeling with different management scenarios to identify potential fire and climate refugia.
- (4) Prepare a 5-year Harbison's Dun Skipper Management Plan that includes the results from butterfly surveys and habitat assessments, genetic and marking studies, and climate and fire modeling to characterize habitat quality at occupied occurrences and unoccupied suitable habitat important for enhancing connectivity, expanding populations or that could serve as fire and climate refugia. Implement highest-priority management actions identified in the Harbison's Dun Skipper Management Plan and monitor effectiveness of implementation of highest-priority management actions.
- (5) Implement high-priority MSP 2018 Wildfire Ignition Reduction Plan measures developed for Harbison's Dun Skipper to reduce the probability of ignition at most at-risk occurrences.
- (6) Continue host plant (San Diego sedge), adult, larval, and hibernaculum surveys, and habitat assessments for Harbison's dun skipper that were

initiated in 2013 in the MSPA (see Table of Occurrences) to further document the butterfly's current distribution and population size, define habitat requirements, and assess habitat and threats at survey sites.

- (7) For at least the first 3 years following a wildfire, monitor recovery of Harbison's dun skipper occurrences and habitat affected by fire and implement management actions identified by post-fire monitoring as necessary to protect and recover Harbison's dun skipper occurrences and habitat impacted by wildfire.

For details and the most up-to-date goals, objectives, and actions, go to the MSP Portal Harbison's Dun Skipper summary page: [https://portal.sdmmp.com/view\\_species.php?taxaid=707282](https://portal.sdmmp.com/view_species.php?taxaid=707282)

### **Harbison's Dun Skipper References**

- Faulkner, D. K., and M. W. Klein. 2012. *Sensitive Butterflies of San Diego County, California*. San Diego, CA: FLITE Tours, Inc.
- Marschalek, D., and D. Deutschman. 2015. *Initial Investigation of Critical Biological Uncertainties for Harbison's Dun Skipper (Euphyes Vestris Harbisoni) on Conserved Lands in San Diego County*. San Diego, CA.
- Marschalek, D., and D. Deutschman. 2016. *Rare Butterfly Management and Conservation Planning: Task 7*. San Diego, CA.

## 2.4 Hermes Copper (*Lycaena hermes*) – Category SL

### Management Units with Known Occurrences

The Hermes copper butterfly is a rare butterfly found in the coastal sage scrub and southern mixed chaparral communities of San Diego County and northern Baja California, Mexico (Deutschman et al. 2010; Faulkner and Klein 2012). Colonies are closely confined to the vicinity of the host and larval food plant, spiny redberry (*Rhamnus crocea*) (Thorne 1963). Although the spiny redberry range extends outside of San Diego into Baja California and north to the Sierra Nevada foothills, Hermes copper is restricted to San Diego County where the temperature extremes are greater than other areas where the plant is found (Faulkner and Klein 2012). Hermes copper is generally found in habitat that supports redberry such as canyon bottoms and hillsides with northern exposure and well-drained soils (Marschalek and Deutschman 2008). Redberry plants need to be mature to support Hermes copper.

Adults prefer to nectar on California buckwheat (*Eriogonum fasciculatum*) but will also nectar on chamise (*Adenostoma fasciculatum*), golden yarrow (*Eriophyllum confertiflorum*), slender sunflower (*Helianthus gracilentus*), poison oak (*Toxicodendron diversilobum*), and the nonnative short-podded mustard (*Hirschfeldia incana*) (Faulkner and Klein 2012). The host and nectar plants should be in proximity to one another (Marschalek and Klein 2010). Hermes copper butterflies are rarely seen far from their host or nectar plants, with the butterflies forming distinct, independent colonies (Thorne 1963).

Hermes copper becomes less active when temperatures reach the mid-90s and will often perch on vegetation within shaded areas (Faulkner and Klein 2012). Similarly, the butterflies may remain inactive and perched when the seasonal marine layer blocks the morning sun.

A 3-year observation at Crestridge Ecological Reserve showed that Hermes copper may have the ability to extend winter diapause during times of extreme drought (Faulkner and Klein 2012). However, it is unclear if larvae are capable of secondary diapause during unfavorable years (Deutschman et al. 2011).

Hermes copper has been detected in MUs 3, 4, 6, 10, and 11 (see Table of Occurrences). There were only two occurrences in MU10 in the Cleveland National Forest. Hermes copper have been detected most often in MU3. These detections

have occurred at 11 preserves: Crestridge Ecological Reserve, Duncan Joseph E. and Bonnie M., Hollenbeck Canyon Wildlife Area, McGinty Mountain Ecological Reserve, McGinty Mountain Preserve, Mount Miguel Open Space, Rancho Jamul Ecological Reserve, San Diego National Wildlife Refuge, Skyline 244, Sycuan Peak Ecological Reserve, and Wright's Field (see online map: <http://arcg.is/2kU2NKH>).

### **Management Categorization Rationale**

Hermes copper should be managed as a Species Management Focus Category SL Species due to a high risk of loss from Conserved Lands in the MSPA and because managing the general vegetation community alone will not ensure persistence of the species (see Vol. 1, Table 2-4). The high risk of loss is due to the small number of existing occurrences, high annual fluctuation in occurrence sizes, low rate of dispersal, and high risk of threat (see Vol. 3, App. 1, Species Profiles).

Hermes copper populations are currently limited to a small portion of San Diego County, which is a substantially smaller range than historic populations (Deutschman et al. 2011). While the species numbers do not fluctuate widely year to year, prolonged drought can reduce population numbers (Thorne 1963). Urban development and increased fire frequency are two substantial threats for the Hermes. "Fire is a large and potentially catastrophic force acting on Hermes copper populations" (Deutschman et al. 2011). New growth redberry, like that after a fire, is incompatible for sustaining Hermes larvae and recolonization of those sites may not occur (Marschalek and Klein 2010). Hermes have suffered from habitat loss and fragmentation as a result of urbanization (Faulkner and Brown 1993).

USFWS has found that listing the species is warranted; however, they are still reviewing data and compiling a thorough review (USFWS 2016).

### **Management and Monitoring Approach**

The overarching goal for Hermes copper is to protect, enhance, and restore occupied habitat and historically occupied habitat and the landscape connections between them to create resilient, self-sustaining populations that provide for persistence over the long term (>100 years).

For the planning cycle of 2017–2021, the management and monitoring approach is the following:

- (1) Continue development of BMPs begun in 2013 for captive rearing Hermes copper at the San Diego Zoo.
- (2) Develop habitat suitability models for Hermes copper and the host plant (spiny redberry), and the primary nectaring plant (California buckwheat) under current and future climate change scenarios, and conduct fire risk modeling with different management scenarios to identify potential climate and fire refugia.
- (3) Complete a 5-year Hermes Copper Management Plan that includes the results from butterfly surveys and habitat assessments and genetic, marking, and translocation studies to develop a management strategy and to identify and prioritize site-specific management actions. Begin implementing high-priority management actions from the Hermes Copper Management Plan and monitor effectiveness of implementation.
- (4) Develop a monitoring plan to track long-term distribution, abundance, and phenology, and to assess habitats and threats at Hermes copper occurrences (see Table of Occurrences), and historically occupied and unoccupied high suitability sites across Conserved Lands in the MSPA. Begin implementing long-term monitoring as specified in the Hermes Copper Monitoring Plan.
- (5) Implement high-priority MSP 2018 Wildfire Ignition Reduction Plan measures to reduce the probability of ignition at most at-risk occurrences.
- (6) Continue surveys for adult Hermes copper (see Table of Occurrences) and habitat assessments begun in 2016 to document the butterfly's current distribution and abundance and to assess habitat and threats at survey sites.
- (7) Continue translocation experiments begun in 2014 to test the effectiveness of releasing eggs and larvae to repopulate the Hollenbeck Canyon Wildlife Area (see Table of Occurrences) where the original population was extirpated by fire and continue monitoring effectiveness of translocation.

- (8) For at least the first 3 years following a wildfire, use a standardized survey protocol to determine the status of Hermes copper occurrences impacted by fire and implement management actions identified by post-fire monitoring as necessary to protect and rehabilitate high-quality habitat to allow for recovery of occurrences impacted by wildfire.

For details and the most up-to-date goals, objectives, and actions, go to the MSP Portal Hermes Copper summary page: [https://portal.sdmmp.com/view\\_species.php?taxaid=777791](https://portal.sdmmp.com/view_species.php?taxaid=777791)

### Hermes Copper References

- Deutschman, D. H., M. E. Berres, D. A. Marschalek, and S. L. Strahm. 2010. *Initial Evaluation of the Status of Hermes Copper (Lycaena Hermes) On Conserved Lands in San Diego County*. San Diego, CA.
- Deutschman, D. H., D. A. Marschalek, and S. L. Strahm. 2011. *Two-Year Evaluation of Hermes Copper (Lycaena Hermes)*. San Diego, CA.
- Faulkner, D. K., and J. W. Brown. 1993. The Hermes Copper, *Lycaena Hermes*. In *Conservation Biology of Lycaenidae (Butterflies)*. Occasional Paper of the IUCN Species of Survival Commission, edited by T. R. New, 8:120–21. International Union for Conservation of Nature and Natural Resources.
- Faulkner, D. K., and M. W. Klein. 2012. *Sensitive Butterflies of San Diego County, California*. San Diego, CA: FLITE Tours, Inc.
- Marschalek, D. A., and D. H. Deutschman. 2008. Hermes Copper (*Lycaena* [Hermelycaena] *Hermes*: Lycaenidae): Life History and Population Estimation of a Rare Butterfly. *Journal of Insect Conservation* 12(2): 97–105.
- Marschalek, D. A., and M. W. Klein. 2010. Distribution, Ecology, and Conservation of Hermes Copper (Lycaenidae: *Lycaena* [Hermelycaena] *Hermes*). *Journal of Insect Conservation* 14:721–30.
- Thorne, Fred. 1963. The Distribution of an Endemic Butterfly *Lycaena Hermes*. *Journal of Research on the Lepidoptera* 2(2): 143–50.
- USFWS (U.S. Fish and Wildlife Service). 2016. *Federal Register- Endangered and Threatened Wildlife and Plants*. Vol. 81.

### **3.0 FISH - SL, SO, SS**

#### **3.1 Arroyo chub (*Gila orcuttii*) – Category SL**

There are no objectives for Arroyo chub in the 2017-2021 planning cycle. This species will be included in future planning cycles.

This page intentionally left blank.



## 4.0 AMPHIBIANS - SL, SO, SS

### 4.1 Arroyo Toad (*Anaxyrus californicus*) – Category SO

#### Management Units with Known Occurrences

The arroyo toad was historically found in coastal drainages and mountains in southern and central California from San Luis Obispo County to San Diego County and northern Baja California (Griffin et al. 1999; USFWS 2009). It has disappeared from approximately 75% of its range and is now primarily found in the headwaters of coastal streams (Jennings and Hayes 1994; USFWS 2009). The arroyo toad breeds and deposits egg masses in slow-moving, shallow, sandy pools bordered by sand and gravel flood terraces (USFWS 2009). Outside of the breeding season, adults are largely terrestrial and use a variety of upland habitats, including sycamore-cottonwood woodlands, oak woodlands, coastal sage scrub, chaparral, and grassland (Holland 1995; Griffin et al. 1999) (see online map: <http://arcg.is/2hlQeVx>).

Known occurrences of arroyo toad since 2000 are largely derived from surveys conducted by USGS and from data in SANBIOS (2012). Based on these sources, significant occurrences of arroyo toad are found on Conserved Lands in 3 watersheds (Tijuana River, San Diego River, and San Dieguito River watersheds) in MUs 3, 4, 5, and 6 (see Table of Occurrences). In the Tijuana River watershed in MU3, arroyo toad is known to occur in only 1 stream system, Lower Cottonwood Creek at the Marron Valley Mitigation Bank. In the San Diego River watershed in MU4, significant occurrences are found along San Vicente Creek in Kimball Valley and on the San Diego River on land owned by Helix Water District. In the San Dieguito River watershed in MUs 5 and 6, significant occurrences are found in 5 areas: lower Santa Ysabel Creek, upper Santa Ysabel Creek, Temescal Creek, Santa Maria Creek, and upper San Dieguito River. Significant occurrences of arroyo toad are also likely to occur on Conserved Lands in MU8 since they have been detected both upstream and downstream of Conserved Lands on the San Mateo and Santa Margarita Rivers. Occurrences of arroyo toad are also found on MUs 9, 10, and 11. A complete listing of all locations where arroyo toad has been detected on Conserved Lands in the MSPA is available in MSP-MOM (2014).

Outside of the MSPA, significant occurrences of the arroyo toad are known to occur on MCB Camp Pendleton (Turschak et al. 2008; USFWS 2009), in Sloan Canyon on the Sweetwater River on property owned by the Sycuan Band of Kumeyaay Nation (USFWS 2009), on private land on the San Luis Rey River (USFWS 1999), and in the upstream portions of streams to the east of the MSPA (upper San Diego River, Sweetwater River, and far upper Santa Ysabel Creek).

### **Management Categorization Rationale**

Arroyo toad should be managed as a Species Management Focus Category SO Species due to a moderate risk of loss of significant occurrences from Conserved Lands in the MSPA (see Vol. 1, Table 2-4). Factors contributing to this moderate risk of loss include the small numbers of isolated occurrences and the high level of threats (see Vol. 3, App. 1, Species Profiles).

Threats to arroyo toad in the MSPA include invasive nonnative aquatic species (e.g., bass, bullfrogs, sunfish), nonnative invasive plants, roads, grazing by livestock, incompatible human recreation (including ORV use), trash dumping, non-seasonal dam releases, altered hydrology, and drought (Madden-Smith et al. 2005; USFWS 2009). In addition, USFWS's 5-Year review (2009) noted that chytridiomycosis, an infectious amphibian disease caused by a fungus (*Batrachochytrium dendrobatidis*), may be a factor in this amphibian's decline.

Densities of arroyo toad are highly variable, fluctuating from year to year depending on the presence of suitable habitat, which is affected by drought, fire, flooding, hydrology, and other climatic and human-induced causes (Madden-Smith et al. 2005; USFWS 2009). USGS has developed a spatial occupancy model for arroyo toad on MCB Camp Pendleton (Miller et al. 2012). They found that arroyo toad presence was lower in perennial streams where the presence of nonnative invasive aquatic species was higher. USGS and a graduate student from Texas A&M University developed a potential and current distribution model for arroyo toad across its range (Treglia et al. 2015). These models can be used to better understand current suitable habitat for arroyo toad.

### **Management and Monitoring Approach**

The overarching goal for arroyo toad is to protect and enhance existing significant occurrences to self-sustaining levels and reestablish occurrences in locations where they previously existed to ensure persistence over the long term (>100 years).

For the planning cycle of 2017–2021, the management and monitoring approach is the following:

- (1) Annually inspect known areas occupied by arroyo toad to identify and reduce threats that can be managed at the local scale, including road crossings, illegal encroachment, ORV use, nonnative plants, trash dumping, grazing by livestock, and incompatible human recreation. Where possible, restrict access to arroyo toad upland and breeding habitats to help prevent disturbance to all arroyo toad life history stages (eggs, larvae, metamorphs, and adults). Activities should be restricted in upland habitat year-round and in breeding habitat during the core of the breeding season (March through July).
- (2) Continue to convene with the working group of land managers, scientists, and local biologists knowledgeable in arroyo toad to review existing conditions of known occurrences on Conserved Lands and to prepare a management plan that considers each site's unique conditions (e.g., hydrology, water quality, threats) and includes actions that will provide for the long-term sustainability of arroyo toad, with consideration for the needs of breeding and estivating toads. The management plan should include actions to reduce risk at occupied sites with high fire risk and post-fire recovery actions. High-priority actions identified in the arroyo toad management plan should be implemented and monitored for effectiveness.
- (3) Conduct routine management actions identified through the IMG regional protocol monitoring, including protecting populations from detrimental human use (e.g., ORV, trampling, altered hydrology), removing invasive plants, and removing aquatic predators and exotic species within the known arroyo toad habitat.
- (4) Establish program and permits to allow emergency management actions for the arroyo toad during or immediately following wildfire events, such as implementation of emergency rescue and temporary translocation, to protect from potential loss or extirpation.
- (5) Implement an arroyo toad rescue program during wildfire events to protect from loss and/or extirpation and monitor the effectiveness of

rescue programs following wildfire events, including both translocation or reintroduction efforts.

- (6) Continue genetic studies of the arroyo toad in San Diego County to evaluate the degree of genetic variation within and between populations and to possibly identify genetic bottlenecks or barriers; this information will also be used to determine source populations to use in reestablishing arroyo toads in previously occupied areas.
- (7) Implement post-fire management actions to ensure the recovery at occupied sites following wildfire events, including invasive plant and animal control, debris/sediment removal, erosion control, or other management actions as needed for 3 years following a fire. Monitor stream conditions and the effectiveness of management actions implemented to assist in recovery of arroyo toad for 3 years following wildfire events.
- (8) Assuming adequate rainfall levels, conduct comprehensive arroyo toad surveys using USGS survey protocols throughout the MSPA on Conserved Lands in known occupied and potential habitat to determine current distribution and status of arroyo toad, collect data on threats and habitat covariates, and identify management needs.

For details and the most up-to-date goals, objectives, and actions, go to the MSP Portal Arroyo Toad summary page:  
[https://portal.sdmmp.com/view\\_species.php?taxaid=773514](https://portal.sdmmp.com/view_species.php?taxaid=773514)

### Arroyo Toad References

- Griffin, P. C., T. J. Case, and R. N. Fisher. 1999. *Radio Telemetry Study of Bufo Californicus, Arroyo Toad Movement Patterns and Habitat Preferences. Technical Report Prepared for the California Department of Transportation.*
- Holland, D. C. 1995. *Sensitive Species Hydroecological Evaluation—Santa Margarita River: Arroyo Southwestern Toad (Bufo Microscaphus Californicus).* Camp Pendleton.

- Jennings, M. R., and M. P. Hayes. 1994. *Amphibian and Reptile Species of Special Concern in California. Report Prepared for California Department of Fish and Game*. Rancho Cordova, CA.
- Madden-Smith, M. C., E. L. Ervin, K. P. Meyer, S. A. Hathaway, and R. N. Fisher. 2005. *Distribution and Status of the Arroyo Toad (Bufo Californicus) and Western Pond Turtle (Emys Marmorata) in the San Diego MSCP and Surrounding Areas*. San Diego, CA.
- Miller, D. A. W., C. S. Brehme, J. E. Hines, J. D. Nichols, and R. N. Fisher. 2012. Joint Estimation of Habitat Dynamics and Species Interactions: Disturbance Reduces Co-Occurrence of Non-Native Predators with an Endangered Toad. *Journal of Animal Ecology* 81:1288–97. DOI:10.1111/j.1365-2656.2012.02001.x.
- MSP-MOM. 2014. *Management Strategic Plan Master Occurrence Matrix*.
- SANBIOS. 2012. Sensitive Species Sightings Geodatabase. <http://catalog.opensandiego.org/opendata/resource/3118/sanbios-ecology/>.
- Treglia, M. L., R. N. Fisher, and L. A. Fitzgerald. 2015. Integrating Multiple Distribution Models to Guide Conservation Efforts of an Endangered Toad. *PLoS ONE* 10 (6). DOI:10.1371/journal.pone.0131628.
- Turschak, G. M., C. S. Brehme, S. L. Schuster, and C. J. Rochester. 2008. *MCBCP Arroyo Toad Monitoring Results for 2006 with Multi-Year Trend Analysis*. 55 pp.
- USFWS (U.S. Fish and Wildlife Service). 1999. *Recovery Plan for the Arroyo Southwestern Toad*.
- USFWS. 2009. *Arroyo Toad 5-Year Review: Summary and Evaluation*. Ventura , California.

This page intentionally left blank.

## 5.0 REPTILES - SL, SO, SS

### 5.1 Southwestern Pond Turtle (*Emys pallida*) – Category SL

#### Management Units with Known Occurrences

The southwestern pond turtle is the only turtle native to coastal California (Madden-Smith et al. 2005). It has historically been found in most coast-facing drainages from Washington to northern Baja California. Once a widespread and common species in Southern California, it has declined substantially to only a few remaining self-sustaining occurrences. The pond turtle is a habitat generalist that occurs in riparian and other wetland habitats with permanent to intermittent water and in freshwater to brackish environments (Holland 1991, 1994; Buskirk 2002). The species prefers habitat with slow-moving flows and woody or rocky debris for basking and underwater refugia (Madden-Smith et al. 2005).

Between 2002 and 2012, USGS conducted surveys of southwestern pond turtle in the MSPA (Brown et al. 2012) and found that pond turtle presence is correlated with low human access and high naturalness of the site (Madden-Smith et al. 2005). Based on the results of their surveys, the only significant occurrence of southwestern pond turtle occurs in MU3 in the Sweetwater River at Sycuan Peak Ecological Reserve (see Table of Occurrences and online map: <http://arcg.is/2kUbbKp>). Southwestern pond turtles have also been detected in MUs 4, 5, 6, 8, 10, and 11. See MSP-MOM for a complete listing of all locations where southwestern pond turtle has been detected on Conserved Lands in the MSPA. The turtles detected in MUs 4, 5, and 6 may only be remnants of historical occurrences and there may be no current reproduction at these detection sites.

#### Management Categorization Rationale

The southwestern pond turtle should be managed as a Species Management Focus Category SL Species due to a high risk of loss from Conserved Lands in the MSPA (see Vol. 1, Table 2-4). Factors contributing to this high risk of loss include the small numbers of existing occurrences, small occurrence sizes, and low rates of recruitment (see Vol. 3, App. 1, Species Profiles).

The delayed sexual maturity and low reproductive output of native pond turtles means that human activities (e.g., habitat alteration, dam operations) may cause rapid declines with very slow recovery (Brooks et al. 1991). Direct habitat loss, in addition to hydrological alterations and nonnative species, has resulted in decreased viable populations of the pond turtle in Southern California (Brattstrom and Messer 1988; Jennings et al. 1992; Jennings and Hayes 1994).

Invasive nonnative aquatic species (e.g., bass, bullfrogs, sunfish), invasive nonnative plant species, and invasive upland species (e.g., feral pigs) are all threats to pond turtles in the MSPA (Madden-Smith et al. 2005). Nonnative turtles serve as vectors for disease and parasites, and compete with pond turtles for critical resources, such as basking sites and food. During a 2002–2003 USGS survey, invasive predatory species were detected at 51 of the 68 sites surveyed. Southwestern pond turtles are more likely to occur at natural sites with limited human access, while nonnative turtles are more likely to occur at artificially modified sites.

During periods of drought, water courses with drinking water reservoirs upstream are more likely to go dry below the dam during the summer months (Madden-Smith et al. 2005). These dry periods may be extended during droughts due to the need to maximize water capture in drinking water reservoirs. In addition, fluctuating water levels may affect shoreline vegetation and invertebrate communities, resulting in suboptimal habitat for pond turtles. It is not known how long pond turtles can survive during extended periods of drought.

Nonnative aquatic species removal, head-starting of pond turtles, and translocation of pond turtles have all been used as strategies for restoring and enhancing pond turtle populations in San Diego County (Brown et al. 2015). Translocation of pond turtles in conjunction with nonnative aquatic species management has been identified as a means of restoring the species to drainages from which they have been extirpated within the region. Translocation can also be used to preserve the genetic makeup of distinct populations through geographic replication. The southwestern pond turtle population at Sycuan Peak Ecological Reserve has approximately doubled since the nonnative aquatic species removal and head-starting programs began in 2009.

## **Management and Monitoring Approach**

The overarching goal for southwestern pond turtle is to protect and enhance existing populations to self-sustaining levels (i.e., 200+ individuals, even sex ratio,



evidence of recruitment) in areas that meet the conditions for long-term management (low human access; high naturalness) and create new self-sustaining occurrences to ensure persistence over the long term (>100 years).

For the 2017–2021 planning cycle, the management and monitoring approach is the following:

- (1) Prepare a management plan for southwestern pond turtles that includes identification of high-priority management actions at sites with self-sustaining populations, as well as actions to establish at least 2 additional pond turtle populations to increase resilience to fire and other threats. Implement highest-priority management actions as identified in the Southwestern Pond Turtle Management Plan and monitor the effectiveness of management actions implemented.
- (2) Establish a program and permits to allow emergency management actions for the southwestern pond turtle during or immediately following wildfire events, such as implementation of emergency rescue and temporary translocation, to protect from potential loss or extirpation. Implement the Southwestern Pond Turtle Rescue Program during wildfire events to protect from loss and/or extirpation. Monitor the effectiveness of the Southwestern Pond Turtle Rescue Program following wildfire events, including translocation or reintroduction efforts.
- (3) Continue efforts to expand and translocate occurrences to self-sustaining levels in MU3 in the Sweetwater and Otay River Watersheds and identify, expand, and translocate pond turtles in at least 2 other watersheds in the MSPA.
- (4) Continue monitoring the effectiveness of translocation experiments at Sycuan Peak Ecological Reserve and Rancho Jamul Ecological Reserve (see Table of Occurrences) and any additional translocated occurrences.
- (5) Implement invasive aquatic animal and invasive plant control at natural and translocated pond turtle occurrences as needed to increase recruitment and basking habitat.
- (6) Biennially inspect the existing occurrences to identify necessary management actions to support the expansion of the occurrence to self-

sustaining levels and conduct routine management actions identified through the IMG regional protocol monitoring, including protecting populations from disturbance, removing invasive plants, and removing aquatic predators and exotic species within the known occupied and suitable habitat.

- (7) Implement post-fire management actions to ensure the recovery of pond turtles at occupied sites following wildfire events, including invasive plant and animal control, debris/sediment removal, erosion control, or other management actions as needed for 3 years after fire.
- (8) Monitor stream conditions and the effectiveness of management actions implemented to assist in recovery of southwestern pond turtle for 3 years following wildfire events.

For details and the most up-to-date goals, objectives, and actions, go to the MSP Portal Southwestern Pond Turtle summary page: [https://portal.sdmmp.com/view\\_species.php?taxaid=668677](https://portal.sdmmp.com/view_species.php?taxaid=668677)

### Southwestern Pond Turtle References

- Brattstrom, B. H., and D.F. Messer. 1988. *Current Status of the Southwestern Pond Turtle, Clemmys Marmorata Pallida, in Southern California. Final Report to California Department of Fish and Game. Contract C-2044.* Sacramento, CA.
- Brooks, R. J., G. P. Brown, and D. A. Galbraith. 1991. Effects of a Sudden Increase in Natural Mortality of Adults on a Population of the Common Snapping Turtle (*Chelydra Serpentina*). *Canadian Journal of Zoology* 69:1314–20.
- Brown, C., S. A. Hathaway, R. N. Fisher, and K. Greer. 2012. *Data Summary for the TransNet Environmental Mitigation Program Grant Agreement 5001140 Regarding Southwestern Pond Turtle Restoration at Sycuan Peak Ecological Reserve.* San Diego, CA.
- Brown, C., M. C. Madden, A. N. Duran, and R. N. Fisher. 2015. *Western Pond Turtle (Emys Marmorata) Restoration and Enhancement in San Diego County, CA 2013-2015.* San Diego, CA
- Buskirk, J. 2002. The Western Pond Turtle, *Emys Marmorata*." *Radiata* 11(3): 3–30. [http://www.pondturtle.com/Buskirk, James R. 2002.pdf](http://www.pondturtle.com/Buskirk_James_R_2002.pdf).

- Holland, D. C. 1991. *A Synopsis of the Ecology and Status of the Western Pond Turtle (Clemmys Marmorata) in 1991. Report to National Ecological Research Center.* San Simeon, CA.
- Holland, D. C. 1994. *The Western Pond Turtle: Habitat and History.* Portland. DOIU:10.2172/171287.
- Jennings, M. R., and M. P. Hayes. 1994. *Amphibian and Reptile Species of Special Concern in California. Report Prepared for California Department of Fish and Game.* Rancho Cordova, CA.
- Jennings, M. R., M. P. Hayes, and D. C. Holland. 1992. A Petition to the U.S. Fish and Wildlife Service to Place the California Red-Legged Frog (*Rana Aurora Draytonii*) and the Western Pond Turtle (*Clemmys Marmorata*) on the List of Endangered and Threatened Wildlife and Plants. Unpublished Request to the U.S. Fish and Wildlife Service. 21 pp. Portland, OR.
- Madden-Smith, M. C., E. L. Ervin, K. P. Meyer, S. A. Hathaway, and R. N. Fisher. 2005. *Distribution and Status of the Arroyo Toad (Bufo Californicus) and Western Pond Turtle (Emys Marmorata) in the San Diego MSCP and Surrounding Areas.* San Diego, CA.

This page intentionally left blank.

## 6.0 BIRDS - SL, SO, SS

### 6.1 Tricolored Blackbird (*Agelaius tricolor*) – Category SL

#### Management Units with Known Occurrences

Tricolored blackbirds are permanent residents of California and are considered a California Species of Special Concern, though their status is currently under evaluation for state and federal listing as a threatened or endangered species. These passerines are the most colonial songbird in North America and typically form large, dense colonies, with specific requirements for breeding in areas that include open accessible water, a protected nesting substrate that includes flooded or thorny/spiny vegetation, and suitable foraging space within a few kilometers of the nesting colony (Beedy and Hamilton 1999).

The history of the tricolored blackbird in San Diego County has been one of continuous decline. According to Unitt (2004), there may be 20–30 colonies around the county, totaling about 5,000–8,000 birds typically concentrated in two areas: north-central San Diego County from Dameron Valley and Oak Grove south to Ramona and Santa Ysabel, and the Campo Plateau from Potrero to Jacumba. On Conserved Lands, these colonial songbirds occur in MUs 1, 3, 4, 5, 6, 7, and 9 (see online map: <http://arcg.is/2hokRNf>). At least five colonies in the county's coastal lowland supported up to 1,000 nests in 1935 and 1936 (Neff 1937), none of which are present currently. Through a collaboration of volunteers from state and federal agency biologists, nongovernmental agencies, industry representatives, and academic scientists, the Tricolored Blackbird Working Group has been conducting statewide surveys every 3 years since 2008 and will be preparing another statewide census for 2017. A sample survey was conducted in 2016 by the working group with results revealing a colony of 2,000 birds from Warner Springs Hwy 79 and Hwy S2 (Vista Irrigation). However, at Rancho Jamul Ecological Reserve, a site typically occupied during the nesting season for more than a decade and with varying population numbers, the 2016 nesting season was the first in many years that no tricolored blackbirds were seen at the site despite the implementation of management actions for habitat enhancement (T. Nelson, pers. comm.).

## **Management Categorization Rationale**

The tricolored blackbird should be managed as a Species Management Focus Category SL because persistence of one or more significant occurrences in the MSPA is at high risk of loss without immediate management action above and beyond that of daily maintenance activities and because management of habitat alone will not ensure its persistence.

Tricolored blackbirds are under threat in southern California on many fronts. A primary threat to this species is undoubtedly the loss and degradation of habitat, which can be attributed to urban development and agricultural practices and conversions (Beedy and Hamilton 1999). They are particularly susceptible to disturbances and habitat loss due to their colonial breeding biology combined with their narrow geographic range (Kelsey 2008). Additional threats include altered hydrological conditions, nest predation, and the loss of nests in silage due to the timing of harvests (Beedy 2008; Tricolored Blackbird Working Group 2009).

## **Management and Monitoring Approach**

The overarching goal for tricolored blackbird is to protect, enhance, and restore occupied and historically occupied habitat to create resilient, self-sustaining populations that provide for persistence over the long term (>100 years).

For the 2017–2021 planning cycle, the management and monitoring approach for the tricolored blackbird is to:

- (1) continue to support statewide survey efforts every 3 years along with supporting El Monte and other current habitat restoration processes;
- (2) inspect occupied habitat and document abundance and record threats to determine management needs;
- (3) conduct routine management and utilize occurrence and threat data to develop a management plan;
- (4) implement the highest priority management actions for tricolored blackbirds, and
- (5) monitor the effectiveness of the recommended management actions.

For details and the most up-to-date goals, objectives, and actions, go to the MSP Portal Tricolored Blackbird summary page: [http://portal.sdmmp.com/view\\_species.php?taxaid=179060](http://portal.sdmmp.com/view_species.php?taxaid=179060)

### Tricolored Blackbird References

- Beedy, E. C. 2008. Tricolored Blackbird. In *California Bird Species of Special Concern*, edited by W. D. Shuford and T. Gardali, pp. 437–443. Western Field Ornithologists, Camarillo, CA and California Department of Fish and Game, Sacramento, CA.
- Beedy, E. C., and W. J. Hamilton III. 1999. Tricolored blackbird (*Agelaius tricolor*). In *The*
- Kelsey, R. 2008. *Results of the Tricolored Blackbird 2008 Census*. Audubon California.
- Neff, J. A. 1937. Nesting Distribution of the Tri-colored Red-Wing. *Condor* 39: 61–81.
- Poole, A. and F. Gill, editors. *Birds of North America*, No. 423. Philadelphia, PA: Academy of Natural Sciences and Washington, DC: American Ornithologists Union.
- Tricolored Blackbird Working Group. 2009. *Conservation Plan for the Tricolored Blackbird (Agelaius tricolor)*, 2.0 Update. Susan Kester (ed.) Sustainable Conservation. San Francisco, CA.
- Unitt, P. 2004. *San Diego County Bird Atlas*. Proceedings of the San Diego Society of Natural History. #39.

## 6.2 Western Snowy Plover (*Charadrius nivosus nivosus*) – Category SL

### Management Units with Known Occurrences

The Pacific coast population of the western snowy plover is a federally threatened and State-Species of Special Concern that breeds primarily from southern Washington to southern Baja California, Mexico, and in interior areas of Oregon, California, Nevada, and several other western states (USFWS 2007). Genetically isolated from western snowy plovers found in the interior of North America (USFWS 1993), the Pacific coast population requires breeding grounds above the high-tide line on coastal beaches, beaches at creek and river mouths, and salt pans at lagoons and estuaries. These plovers may also take advantage of bluff-backed beaches, dredged material disposal sites, salt pond levees, dry salt ponds, and river bars (USFWS 2007).

Monitoring of this species is intensive and has been ongoing since 1977 by the Point Reyes Bird Observatory. In San Diego county, monitoring of populations on military installations started in 1999, while USGS intensely monitored these plovers in San Diego County from 1994 through 1998 (Powell et al. 2002; USFWS 2007). Unitt (2004) reports that populations are found largely in MCB Camp Pendleton at the Santa Margarita River mouth, Batiquitos Lagoon, and Silver Strand State Beach, with occurrences mostly observed in MUs 1, 6, and 7. The results of the 1994 through 1998 USGS surveys indicated the continual high risk of decline and possible local extinction of the Pacific coast population (Powell et al. 2002). View a map of detections at: <http://arcg.is/2i97ZJT>.

### Management Categorization Rationale

The western snowy plover should be managed as a Species Management Focus Category SL because persistence of one or more significant occurrences in the MSPA is at high risk of loss without immediate management action above and beyond that of daily maintenance activities and because management of marine habitats alone will not ensure its persistence.

Pacific coast populations of the western snowy plover continue to face multiple threats in southern California. A primary threat to this species, at both the regional and preserve levels, is the destruction and degradation of habitat (USFWS 2007). This threat can be attributed to urban development, disturbances from human



activities (e.g., shoreline stabilization, dredging, and increasing levels of human recreation), and introduced species. Additional threats include altered hydrological conditions and nest predation. USFWS (1993) concluded that a combination of habitat loss and anthropogenic disturbances has led to a decline in active nesting colonies and overall decline on this population of the western snowy plover.

### **Management and Monitoring Approach**

The overarching goal for western snowy plover is to protect, enhance, and restore occupied and historically occupied habitat to create resilient, self-sustaining populations that provide for persistence over the long term (>100 years).

For the 2017–2021 planning cycle, the management and monitoring approach for the western snowy plover is to:

- (1) continue monitoring conserved occurrences annually through 2021 to document abundance, record threats, and identify necessary management actions;
- (2) implement routine management as determined during monitoring;
- (3) refine BMPs based on the results of ongoing management experiments;
- (4) use occurrence status, threat data, and BMPs to develop a joint management recommendation for the western snowy plover for regional support;
- (5) continue support for ongoing CDFW surveys;
- (6) implement the highest-priority management actions for western snowy plover, and
- (7) monitor the success of the recommended management actions.

For details and the most up-to-date goals, objectives, and actions, go to the MSP Portal Western Snowy Plover summary page: [http://portal.sdmmp.com/view\\_species.php?taxaid=824565](http://portal.sdmmp.com/view_species.php?taxaid=824565).

**Western Snowy Plover References**

- Powell, A. N., C. L. Fritz, B. L. Peterson, J. M. Terp. 2002. Status of Breeding and Wintering Snowy Plovers in San Diego County, California, 1994–1999. *Journal of Field Ornithology* 73(2):156–165.
- Unitt, P. 2004. *San Diego County Bird Atlas*. Proceedings of the San Diego Society of Natural History #39.
- USFWS (U.S. Fish and Wildlife Service). 1993. Endangered and Threatened Wildlife and Plants; Determination of Threatened Status for the Pacific Coast Population of the Western Snowy Plover; Final Rule. *Federal Register* 58(42):12864–12874.
- USFWS. 2007. *Recovery Plan for the Pacific Coast Population of the Western Snowy Plover (Charadrius alexandrius nivosus)*. Sacramento, California.
- .

### 6.3 Golden Eagle (*Aquila chrysaetos canadensis*) – Category SO

#### Management Units with Known Occurrences

The golden eagle is distributed throughout much of the Northern Hemisphere and in western North America is most common in grasslands and open shrublands where it forages for rabbits, jack rabbits, ground squirrels, and other small mammals (Kochert et al. 2003). It nests on cliffs and occasionally in large trees.

Golden eagle nesting territories in San Diego County have been monitored by various raptor biologists since the late 1800s, with monitoring since the 1990s through the present conducted by Wildlife Research Institute (WRI). Beginning in the fall of 2014, a multi-year survey and tracking program was initiated and developed through a collaborative effort between USGS, USFWS, CDFW, and SDMMMP to determine the status of the golden eagle. Based on the historical and recent data compiled by WRI (Bittner et al. 2010 [confidential report to SANDAG]), there are 11 active (recent nesting) territories in MUs 3, 4, and 5 and 2 inactive territories (adult pair not observed for several years) in MUs 3 and 6. MU8 was not included in the WRI surveys but also has active golden eagle territories. More recently, USGS trapped 26 golden eagles from November 2014 through February 2016, with 21 eagles captured in San Diego County, and is actively tracking 11 eagles (USGS 2016). See the online map for active and inactive nesting territories on Conserved Lands. Extirpated territories are not included on the map. Territories are considered “extirpated” when 5 years pass from the last recorded breeding and/or sighting of the pair or a single eagle on the territory (Bittner et al. 2010). Due to the sensitivity of the data, only territory names and foraging territory boundaries are provided on the map (contact the SDMMMP for nest site locations).

There are 5 active and 1 inactive golden eagle nesting territories known to occur in MU3 in the South County area: Cedar Canyon, Copper Canyon (Butteweg Canyon, Otay Mountain), Lyon’s Peak, O’Neal Canyon, San Miguel Mountain, and Tecate Peak (Marron Valley). The South County area contains large blocks of Conserved Lands with open habitat suitable for foraging golden eagles. There are 4 active golden eagle nesting territories known to occur in MU4 (El Cajon, Iron Mountain, Rock Mountain, and San Vicente Reservoir) and 2 active nesting territories in MU5. The nest sites in MU5 both occur on private property, but foraging territories overlap with Conserved Lands. The only known golden eagle nesting territory in MU6 occurs in the Lake Hodges/Del Dios Highlands area, is surrounded by urban

development, and has not had an active nest since 2003. Golden eagles have likely been extirpated from this territory. Foraging habitat and nesting areas for golden eagle are found in MU8 at Gregory Canyon and potentially other areas, but the SDMMMP was unable to obtain the current information on these other sites.

### **Management Categorization Rationale**

Golden eagles should be managed as a Species Management Focus Category SO Species due to a high risk of loss of nesting territories from Conserved Lands in the MSPA and because managing vegetation alone will not ensure persistence of the species (see Vol. 1, Table 2-4). Golden eagles should be managed at a species-specific level due to nest site fidelity and associated foraging area management needs, potential loss of locally produced floaters (i.e., future recruitment to the MSPA population) at wind energy facilities outside of the MSPA, and pair requirements in conservation plans within the MSPA.

Threats to golden eagles in the MSPA include urbanization and human use of preserves that disturb nest sites and nesting pairs, ravens preying on young in the nest, and direct mortality from powerline and wind power facilities (Kochert et al. 2002; Bittner et al. 2010). Altered fire regimes may affect nest site stability/nest destruction, change prey distributions, and potentially cause direct mortality.

### **Management and Monitoring Approach**

The overarching goal for the golden eagle is to protect, enhance, and restore occupied and historically occupied habitat to create resilient, self-sustaining populations that provide for persistence over the long term (>100 years).

For the 2017–2021 planning cycle, the management and monitoring approach for the golden eagle is to:

- (1) Continue the golden eagle nesting, foraging, and habitat use study to monitor golden eagle territory occupancy and reproduction in the MSPA (see Table of Occurrences) and to track eagle movements to identify important foraging, nesting, and roosting areas. Continue to study the influence of human activity and land use on patterns of eagle movement and habitat use, measure the response of eagles to human activity while foraging, and determine whether locally produced floaters recruit into the breeding population.

- (2) Continue the golden eagle genetics study and collect genetic samples in conjunction with eagle captures for the golden eagle nesting, foraging, and habitat use study. Analyze these samples to determine the population genetic structure of golden eagles within the MSPA (see Table of Occurrences) and their relationship to eagle populations in other parts of the western United States.
- (3) Use the results and recommendations from the golden eagle nesting, foraging, and habitat use study and the golden eagle genetics study to develop a comprehensive Golden Eagle Management Plan for managing golden eagle territories with nesting, roosting, and foraging habitat on Conserved Lands within the MSPA (see Table of Occurrences). The plan should include recommendations for managing important foraging habitat to minimize human disturbance to foraging eagles and to improve habitat quality to enhance prey availability, especially during drought periods. The plan should also include specifications to control human disturbance that could discourage nesting, cause nest abandonment, or adversely affect the survival of nestlings, and for managing unstable nest ledges or tree nest sites that are critical to maintaining a breeding pair in territories with limited nesting sites.
- (4) Use the results and recommendations from the golden eagle nesting, foraging, and habitat use study and the golden eagle genetics study to develop a comprehensive Golden Eagle Monitoring Plan for monitoring golden eagle status and assessing nesting, roosting, and foraging habitat on Conserved Lands within the MSPA (see Table of Occurrences). The plan should include standardized monitoring protocols to track the status of eagles at nesting territories, to monitor use of important foraging areas, and to collect habitat and threats covariate data to inform needed management actions.

For details and the most up-to-date goals, objectives, and actions, go to the MSP Portal [Golden Eagle summary page: https://portal.sdmmp.com/view\\_species.php?taxaid=175408](https://portal.sdmmp.com/view_species.php?taxaid=175408)

## Golden Eagle References

Bittner, John D., C. Meador, Brittany Schlotfeldt, and Renée Rivard. 2010. *Report on the Status of the Golden Eagle in the San Diego MSCP 2004–2010*.

Confidential report prepared by the Wildlife Research Institute, Inc. for the San Diego Association of Governments.

- Kochert, M. N., K. Steenhof, C. L. McIntyre, and E. H. Craig. 2003. Golden Eagle (*Aquila chrysaetos*), *The Birds of North America Online* (A. Poole, Ed.), Ithaca: Cornell Lab of Ornithology; Retrieved from the Birds of North America Online: <http://bna.birds.cornell.edu/bna/species/684>. DOI: 10.2173/bna.684.
- USGS (U.S. Geological Survey). 2016. Biotelemetry Data for Golden Eagles (*Aquila chrysaetos*) Captured in Coastal Southern California, November 2014–February 2016: U.S. Geological Survey Data Series 994, 32 p. Prepared for San Diego Association of Governments, California Department of Fish and Wildlife, Bureau of Land Management, and U.S. Fish and Wildlife Service.

## 6.4 Western Burrowing Owl (*Athene cunicularia hypugaea*) – Category SL

### Management Units with Known Occurrences

Western burrowing owl breeds in grasslands and open scrub from southern Canada south into the western United States and northern Mexico (Macias-Duarte 2011). This species was once common throughout San Diego County (Unitt 2004), but began declining in the early 1900s with increasing urban and rural development, and by the late 1970s numbered only around 250 to 300 pairs (Lincer and Bloom 2007). In 2007, an estimated 47 pairs of resident burrowing owls remained in San Diego County.

Recent (since 2000) locations of nesting burrowing owl (defined as detections between March and August) are derived from multiple sources. CDFW conducted a use survey of artificial and known historic natural burrows in 2010, 2011, and 2012. In addition, incidental sighting data are available from SANBIOS (2012) and Caltrans (provided by M. Galloway 2012). A survey for raptors in San Diego County was conducted by WRI between 2001 and 2003 (WRI 2005), which included burrowing owl, but the data were not used because sites listed appeared to already be accounted for in the above sources or were on nonconserved lands. The San Diego Zoo Institute for Conservation Research has been monitoring core areas of the Otay Mesa population since 2013 (San Diego Zoo Insitutute for Conservation Research 2016) and, in collaboration with the Institute for Ecological Modeling and Management, initiated a scientific, ecologically relevant strategy for relocating California ground squirrels to improve grassland habitat focused on aiding the recovery of western burrowing owls and their grassland ecosystem in 2011 (Hennessy et al. 2015). No County-wide occurrence monitoring data exist for burrowing owl and numbers of owls in the various datasets cannot be used to determine occurrence size due to varying levels of effort and potential for double counting. Therefore, numbers of burrowing owls detected are not provided in the MSP tables.

Based on the above sources, nesting burrowing owls have recently been detected on Conserved Lands in MUs 3 and 5 (refer to online map: <http://arcg.is/2kFRjx7>) with winter observations of owls in MUs 4 and 6. Outside the MSPA, burrowing owls nest at U.S. Naval Base North Island, though successful nesting has not been observed since 2011 (San Diego Zoo Insitutute for Conservation Research 2016).

Nesting burrowing owls have been reported recently (2010) in artificial burrows on and adjacent to the Ramona Grasslands Open Space Preserve in MU5. This area represents the only other relatively large, intact area in the MSPA where multiple burrowing owl pairs are known to nest in recent history. There have been no recent reported detections of nesting burrowing owls on Conserved Lands in MUs 2, 7, 8, 10, and 11.

### **Management Categorization Rationale**

Burrowing owl should be managed as a Species Management Focus Category SL Species due to a high risk of loss from Conserved Lands in the MSPA. This designation is due to its limited distribution within the MSPA, small breeding occurrences, recent loss of occurrences from Conserved Lands, lack of suitable nesting habitat, and high degree of threat (see Vol. 1, Table 2-4).

Threats to burrowing owl include increased nonnative grass and forb cover leading to a reduction in suitable, open nesting and foraging habitat. Burrowing owl is also vulnerable to predation by coyotes, raptors, and other predators. Second generation rodenticides could impact owls through indirect ingestion from prey (see Klute et al. 2003). Within the MSPA, there is the potential for electrocution at the Otay Mesa State Prison (official name: Richard J. Donovan State Correctional Facility; refer to annual reports for the Statewide Lethal Electrified Fence Project; AECOM and Ascent Environmental 2010).

### **Management and Monitoring Approach**

The overarching goal for western burrowing owl is to protect, enhance, and restore occupied and historically occupied habitat to create resilient, self-sustaining populations that provide for persistence over the long term (>100 years).

For the 2017–2021 planning cycle, the management and monitoring approach for the western burrowing owl is to:

- (1) Continue the research study of breeding burrowing owls, foraging, threats, artificial and natural burrows, movements, and habitat assessments to inform management at existing occupied and future potential nodes. Include translocated owls in the study to determine effectiveness of translocation and to gather information to inform continued management at new nodes.



- (2) Annually inspect artificial and natural burrows and occupied habitat to determine management needs using a regional "IMG" protocol. The monitoring should include considerations for retrofitting existing artificial burrows with the most current design to maximize fledgling success, removal/closing of burrows at poorly performing sites, and addition of burrows to maximize success.
- (3) Conduct management actions identified through the IMG regional protocol monitoring, including protecting populations from disturbance; removing invasive plants; cleaning, repairing, and fortifying burrows within the known occupied and suitable habitat; retrofitting existing artificial burrows with the most current design to maximize fledgling success; removal/closing of burrows at poorly performing sites; and addition of burrows to maximize success.
- (4) Finalize the Burrowing Owl Conservation and Management Plan that includes results from the research study and habitat assessments, recommendations for the establishment of at least two nodes and enhancement of existing occurrences to ensure persistence on Conserved Lands, and establishment of a captive breeding population as a source for burrowing owls.
- (5) Implement highest-priority management actions from the Burrowing Owl Conservation and Management Plan and monitor the effectiveness of management actions implemented.

For details and the most up-to-date goals, objectives, and actions, go to the MSP Portal Western Burrowing Owl summary page: [https://portal.sdmmp.com/view\\_species.php?taxaid=687093](https://portal.sdmmp.com/view_species.php?taxaid=687093).

### **Western Burrowing Owl References**

County of San Diego. 2016. SanBIOS [dataset]. Accessed July 22, 2016. [sangis.org](http://sangis.org).

Galloway, M., and T. Thurston. "Burrowing Owls at Lonestar Ridge West". Presentation, 2012.

Hennessy, S. H., C. Wisinski, J. P. Montagne, K. Marshall, D. M. Shier, R. R. Swaisgood, and L. A. Nordstrom. 2015. *Project Report 2015: An Adaptive*

*Management Approach to Recovering Burrowing Owl Populations and Restoring a Grassland Ecosystem in San Diego County.* San Diego Zoo Institute for Conservation Research. Prepared for San Diego Foundation.

Klute, David S., William H. Howe, Steven R. Sheffield, Loren W. Ayers, Stephanie L. Jones, Tara S. Zimmerman, Michael T. Green, and Jill A. Shaffer. 2003. *Status Assessment and Conservation Plan for the Western Burrowing Owl in the United States.* US Department of the Interior, Fish and Wildlife Service, Biological Technical Publication FWS/BTP-R6001-2003, Washington, D.C.

Lincer, J., and P. H. Bloom. 2007. The Status of the Burrowing Owl in San Diego County, California. In *Proceedings of the California Burrowing Owl Symposium*: 90–102.

Macias-Duarte, Alberto. 2011. Change in Migratory Behavior as a Possible Explanation for Burrowing Owl Population Declines in Northern Latitudes. Dissertation submitted to the University of Arizona.

San Diego Zoo Institute for Conservation Research. 2016. *Burrowing Owl Conservation and Management Plan for San Diego County.* San Diego, CA. 39 pp.

Unitt, Phil. 2004. *San Diego County Bird Atlas.* San Diego, California: No. 39 Proceedings of the San Diego Natural History Museum

WRI (Wildlife Research Institute). 2005. *Final Report – NCCP/MSCP Raptor Monitoring Project (January 1, 2001 – December 31, 2003).* Prepared by the Wildlife Research Institute, Inc. for the California Department of Fish and Game.

## **6.5 Coastal Cactus Wren (*Campylorhynchus brunneicapillus sandiegensis*) – Category SO**

### **Management Units with Known Occurrences**

Coastal cactus wrens are restricted to cactus-dominated coastal sage scrub habitats in Southern California, from Ventura south to San Diego County and inland to western San Bernardino and western Riverside Counties. These wrens differ ecologically from more common desert wrens in the southwestern United States and northern Mexico. Coastal cactus wrens began significantly declining in San Diego County in the early 1980s due to habitat loss to agriculture and urban development (Rea and Weaver 1990). By 1990 there was a 33% population decline from the previous decade as a result of the loss of coastal birds and smaller populations, and a decline in abundance of remaining populations.

Coastal cactus wren surveys and cactus mapping were implemented on Conserved Lands in the MSPA in 2009 and 2011 (USFWS 2011). Cactus wrens were documented on Conserved Lands in MUs 1, 2, 3, 4, 5, and 6 (see Occurrence Table and online map: <http://arcg.is/2kU1bka>). A range-wide genetics and banding study was conducted across occupied cactus scrub habitats in 2011–2013 by USGS to determine coastal cactus wren population genetic structure, connectivity, and genetic diversity in Southern California (Barr et al. 2015). The study found 3 main genetic clusters in San Diego County: Otay; San Diego/El Cajon (Sweetwater/Encanto/Lake Jennings); and San Pasqual. In the San Diego/El Cajon genetic cluster, wrens in the Sweetwater River watershed are connected to occurrences in Fletcher Hills and Lake Jennings to the northeast in MU4 and to occurrences in Encanto Canyon and other urban canyons to the west in MU2. The physical habitat connections between occurrences are tenuous due to development. Wrens in the Otay River and Tijuana River watersheds are within the Otay Genetic Cluster and are considered isolated from the San Diego/El Cajon Genetic Cluster (and potentially to occurrences in Mexico) even though the physical distance is close. Cactus wrens in MUs 5 and 6 are within the San Pasqual/Lake Hodges genetic cluster.

The USFWS (USFWS 2011) and USGS surveys (USGS 2011, 2012) found cactus wrens in south San Diego County in low numbers in the Tijuana Slough NWR and in the urban canyons of San Diego and Chula Vista, with larger concentrations at Otay

River Valley, the Sweetwater Reservoir, and Lake Jennings. The largest concentration of cactus wrens on Conserved Lands is in San Pasqual Valley with several additional pairs at Lake Hodges. Coastal cactus wrens were not detected on Conserved Lands in MUs 7 or 8 during the 2009–2011 USFWS surveys. However, during 2011–2012 USGS surveys, a few pairs were found on private lands in the Pauma Valley area of MU8. MCB Camp Pendleton and Naval Weapons Station Fallbrook have a large cluster of wrens largely isolated from populations on Conserved Lands within the MSPA.

More recently, the focus has been on south San Diego County with surveys in 2014 and 2015 and a study of cactus wren breeding, dispersal, survival, and foraging in 2015 and 2016. These surveys show that small and isolated occurrences of wrens have disappeared from the southern portion of San Diego County and the number of pairs has declined at larger occurrences (USGS 2011, 2012, 2013, 2014, 2015, 2016; TNC and SDMMP 2015). This decline is attributed in part to a prolonged drought from 2011–2016, with some signs of increase at still extant populations in 2016 (TNC and SDMMP 2015). In north San Diego County, the Lake Hodges population of wrens has declined significantly since the 2007 wildfires, and in 2016 was down to one pair with fledglings (Mahrtdt and Weaver 2016).

### **Management Categorization Rationale**

Coastal cactus wrens should be managed as a Species Management Focus Category SO Species due to a high risk of loss of occurrences from Conserved Lands in the MSPA, particularly from the Tijuana, Otay, Encanto, Sweetwater, Lake Jennings, and Lake Hodges locations and because managing vegetation alone will not ensure persistence of the species (see Vol. 1, Table 2-4). Coastal cactus wren should be managed at a species-specific level due to the isolation of occurrences and small effective population sizes, low dispersal ability of individuals (Barr et al. 2015, and specific habitat requirements (i.e., large cacti) (TNC and SDMMP 2015).

While the primary management action is to increase and enhance suitable habitat at locations with cactus wrens and to improve connectivity, other potential species management actions may be necessary if populations continue to decline. These management actions include supplemental feeding during drought to enhance productivity and potentially survivorship, egg switching to increase genetic

diversity, predator management, and translocation of salvaged individuals from locations slated for development.

Cactus wren occurrences face many threats in Southern California (see species profile at [https://portal.sdmmp.com/species\\_profile.php?taxaid=917698](https://portal.sdmmp.com/species_profile.php?taxaid=917698)). The loss and fragmentation of cactus scrub from urban development is a primary factor in the decline of coastal cactus wren since the 1980s (Rea and Weaver 1990; Solek and Szijj 2004; Hamilton et al. 2011). Based on the USGS genetics study of coastal cactus wrens, wrens are poor dispersers especially in fragmented habitats, with most movements less than 1 kilometer, although the least fragmented population had some individuals dispersing up to 8 kilometers (Barr and Vandergast 2014; Barr et al. 2015). Two field studies in Orange and Los Angeles Counties found similar results with the majority of color-banded juvenile wrens dispersing less than 1 kilometer from their natal territories (Atwood et al. 1998; Preston and Kamada 2012; Kamada and Preston 2013).

Habitat loss and fragmentation and an overall poor dispersal ability of coastal cactus wrens have led to genetic differentiation between clusters of wrens and loss of genetic diversity over the last 100 years (Barr and Vandergast 2014; Barr et al. 2015). The number of individuals contributing to offspring in the next generation is known as the effective population size ( $N_e$ ) and is small for coastal cactus wren populations (Barr et al. 2015). Geographic isolation and small population size lead to loss of genetic diversity through genetic drift and can result in inbreeding depression. Populations with  $N_e$  of  $<50$ , such as the Otay and San Diego/El Cajon (=Sweetwater/Encanto/Lake Jennings) genetic clusters, can face inbreeding depression over five generations in the wild and are at immediate risk of extinction because inbreeding depression and demographic stochasticity can result in an extinction vortex (Franklin 1980; Frankham et al. 2014).  $N_e \geq 100$  is recommended as a short-term recovery target to limit loss of fitness to  $\leq 10\%$  (Frankham et al. 2014), although other authors recommend  $N_e > 50$  as sufficient (Franklin et al. 2014). The San Pasqual cluster has a  $N_e$  between 50 and 100. A long-term recovery target is to retain evolutionary potential or the ability of species to adapt to changing conditions, for which a  $N_e$  of at least 1,000 is recommended (Frankham et al. 2014).

As a result of their limited dispersal abilities and increasing habitat fragmentation, small cactus wren occurrences are more vulnerable to extinction (TNC and SDMMP

2015) from demographic and environmental stochasticity or from threats such as wildfire, changing climate, and habitat degradation.

A major threat to coastal cactus wrens over the last 25 years is an altered fire regime that causes direct mortality of birds and destroys cactus scrub, which can take many years to recover (Bontrager et al. 1995; Mitrovich and Hamilton 2007; Hamilton 2008; Leatherman BioConsulting 2009). In San Diego County, wildfires in 2003 and 2007 impacted wrens in 3 areas. The 2003 Cedar Fire burned through the Lake Jennings occurrence. The 2007 Witch Creek fire burned through the largest concentration of wrens in the San Pasqual Valley/Lake Hodges area, with lower fire intensity and damage to habitat in the valley compared with Lake Hodges (Hamilton 2008; Conlisk et al. 2014; Mahrtdt and Weaver 2015, 2016). The 2007 Harris wildfire impacted cactus wren occurrences at Sweetwater Reservoir and San Miguel Mountain (REGS 1998; USFWS 2011; USGS 2011, 2012, 2013, 2014, 2015, 2016; CNDDDB 2015).

Under climate change, a warming and drying climate, with more frequent, intense and prolonged droughts, is predicted for Southern California (Diffenbaugh et al. 2015), which could be a threat to wrens in the future. The amount and timing of rainfall affects primary productivity and insect abundance in semi-arid systems and food availability with limited food availability in low rainfall years, and has been linked to the productivity of several shrubland bird species in Southern California (Morrison and Bolger 2002; Bolger et al. 2005; Preston and Rotenberry 2006). A 5-year study of coastal cactus wrens in Orange County found the most important predictors for number of fledglings produced each year were higher January through April precipitation and January through February temperatures, and earlier dates of first egg laying (Preston, unpublished data). In San Diego County, there was very low productivity in 2014, a severe drought year (USGS 2014). In 2015 and 2016, rainfall was below normal, but early rains and warm winter temperatures in January and February led to very early egg laying in February while spring rains extended breeding into August. Despite high rates of nest predation, wren pairs were able to re-nest multiple times in 2015 and 2016, and both years ended with average productivity (USGS 2015, 2016).

Other threats include habitat degradation from invasive plant species potentially reducing open habitat for foraging and affecting food availability by altering arthropod community composition and abundance (Preston and Kamada 2012;

Kamada and Preston 2013). In areas with an absence of fire, such as urban canyons, shrubs can overgrow and crowd cactus patches with wrens disappearing from these areas (TNC and SDMMP 2015). Adult, juvenile, and nestling wrens are vulnerable to predation by domestic cats, roadrunners, snakes, loggerhead shrikes, and especially Cooper's hawks (Solek and Szijj 2004; Preston and Kamada 2012). They may be especially vulnerable in urban areas, where there are more human subsidized predators that concentrate hunting in natural habitat fragments.

### **Management and Monitoring Approach**

The overarching goal for coastal cactus wren is to protect, enhance, and restore suitable cactus scrub habitat for coastal cactus wrens to increase effective population size in each genetic cluster at a short-term sustainable level (e.g., 50–100 wrens), rehabilitate habitat destroyed by wildfire, improve habitat quality to maintain populations during drought, enhance connectivity within and between genetic clusters to increase genetic diversity and rescue small populations, and manage anthropogenic predation risk to ensure long-term persistence (>100 years) of cactus wrens on Conserved Lands in the MSPA.

For the planning cycle of 2017–2021, the management and monitoring approach is to:

- (1) Continue to expand local populations and to improve genetic connectivity between remaining populations in order to increase population resilience to environmental and demographic stochasticity and to increase genetic diversity.
- (2) In south San Diego County, restore  $\geq 70$  acres of high-quality habitat and increase the population to  $\geq 75$  territories on Conserved Lands in MUs 2, 3, and 4. The focus is to restore cactus scrub habitat to expand existing populations and to connect occurrences within the San Diego/El Cajon and Otay genetic clusters.
- (3) For the San Pasqual genetic cluster, restore  $\geq 75$  acres of high-quality habitat and expand to  $> 90$  territories in MU6 by increasing habitat at sites with small numbers of wrens or sites in close vicinity and connect Lake Hodges birds to those in the San Pasqual Valley (Barr and Vandergast 2014; Barr et al. 2015). Cactus wren projects are prioritized based on the

recommendations and strategies of the South San Diego County Coastal Cactus Wren Habitat Conservation and Management Plan (TNC and SDMMMP 2015) and Institute for Conservation Research's (ICR) Restoration Analyses for the San Pasqual Valley/Lake Hodges genetic cluster (Conlisk et al. 2014).

- (4) To support cactus scrub restoration projects and to ensure a supply of cacti after wildfires, an important objective is to establish and maintain 2 cactus nurseries that would focus on growing cacti, with cholla emphasized in the south county and prickly pear in the north county.
- (5) Monitor the success of cactus restoration projects in north and south San Diego County by collecting vegetation data over time and analyzing it across projects to determine if adjustments should be made to management techniques and strategies.
- (6) Continue the 5-year Coastal Cactus Wren Demography, Vegetation and Arthropod Study initiated in 2015 (CAMBRU-4) to document cactus wren productivity, dispersal, and survival in the Otay and San Diego/El Cajon genetic clusters. This study also investigates habitat quality by measuring vegetation at the territory level and conducting a study of arthropod community composition in relation to specific plant species and relating this to nestling diets. It is comparable to a similar study conducted in the Coastal Reserve in Orange County (Pratt 2013) and combined results will be important in developing management recommendations on planting palettes that support diverse and abundant arthropod communities to increase wren food availability for wrens, especially during drought. The study will also provide information to assess the status of wrens and factors associated with reproduction and survival and to inform next steps in management.
- (7) Cactus wren populations will be surveyed annually until 2021 using a standardized protocol and established plots in the south county to fully document dispersal and survival of banded birds from the demography study and to determine the number of occupied territories at each site over time. Habitat assessments will be conducted each year using a standardized protocol to determine management needs. The San Pasqual genetic cluster will also be surveyed in 2018 and 2021 to gather data on current status and dispersion of territories at sites and habitat conditions. The survey plots



were established in 2009 and 2011 at sites across the MSPA with mapped cacti and were monitored in subsequent years to help document changes in the number, location, and characteristics of territories over time. Data will be analyzed and management recommendations provided to inform future management.

- (8) The genetic study will be repeated for south San Diego County to determine if  $N_e$  has increased or decreased in the genetic clusters and whether there is any change in genetic diversity and connectivity since 2011 and 2012. A focus of the study is to determine if inbreeding threatens the long-term persistence of populations in the genetic cluster and to determine whether more active management is needed (e.g., egg switching) to enhance population persistence. The genetic study is planned to be conducted in collaboration with the Natural Community Coalition in Orange County's Coastal Subregion to provide greater insight into patterns of genetic change related to management actions and to changes in environmental conditions.
- (9) Pre-fire management consists of identifying sites where a lot of shrub crowding exists as well as invasive nonnative grasses that could increase severity and impacts from wildfire. These sites will be prioritized and managed to reduce fire risk through vegetation trimming/removal and invasive species control.
- (10) Following a wildfire, wren and habitat recovery should be monitored for at least 3 years with standardized protocols, and the results should be used to inform annual management to enhance post-fire recovery. Management should be implemented as needed for at least 3 years. If cactus wren recovery and/or habitat recovery is poor, then additional years of monitoring and management may be required.

For details and the most up-to-date goals, objectives, and actions, go to the MSP Portal Coastal Cactus Wren summary page: [https://portal.sdmmp.com/view\\_species.php?taxaid=917698](https://portal.sdmmp.com/view_species.php?taxaid=917698).

**Coastal Cactus Wren References**

- Atwood, J. L., D. R. Bontrager, M. Fugagli, R. Hirsch, D. Kamada, M. Madden, C. Reynolds, S. Tsai, and P. A. Bowler. 1998. *Population Dynamics, Dispersal and Demography of California Gnatcatchers and Cactus Wrens in Coastal Southern California (1997 Progress Report)*.
- Barr, K. R., B. E. Kus, K. L. Preston, S. Howell, E. Perkins, and A. G. Vandergast. 2015. Habitat Fragmentation in Coastal Southern California Disrupts Genetic Connectivity in the Cactus Wren (*Campylorhynchus brunneicapillus*). *Molecular Ecology* 24:2349–2363.
- Barr, K. R., and A. G. Vandergast. 2014. *Historical Population Structure and Genetic Diversity in the Cactus Wren in Coastal Southern California*. Data Summary Report prepared for SANDAG.
- Bolger, D. G., M. A. Patten, and D. C. Bostock. 2005. Avian Reproductive Failure in Response to an Extreme Climatic Event. *Oecologia* 142:398–406.
- Bontrager, D. R., R. A. Erickson, and R. A. Hamilton. 1995. Impacts of the October 1993 Laguna Canyon Fire on California Gnatcatchers and Cactus Wrens. In *Brushfires in California Wildlands: Ecology and Resource Management*. Keeley, J. E. and T. Scott (Eds.), International Association of Wildland Fire, Fairfield, WA.
- Conlisk, E., S. Motheral, R. Chung, C. Wisinski, and B. Endress. 2014. Using Spatially-Explicit Population Models to Evaluate Habitat Restoration for the San Diego Cactus Wren (*Campylorhynchus brunneicapillus sandiegensis*). *Biological Conservation* 175:42–51.
- Diffenbaugh, N. S., D. L. Swain, and D. Touma. 2015. Anthropogenic Warming has Increased Drought Risk in California. *Proceedings of the National Academy of Sciences* 112:3931–3936.
- Frankham, R., C. J. A. Bradshaw, and B. W. Brook. 2014. Genetics in Conservation Management: Revised Recommendations for the 50/500 Rules, Red List

- Criteria and Population Viability Analyses. *Biological Conservation* 170:56–63.
- Franklin, I. R. 1980. Evolutionary Changes in Small Populations. In: Soulé, M. E. and B. A. Wilcox (Eds.), *Conservation Biology: An Evolutionary-ecological Perspective*. Sinauer Associates, Sunderland, Massachusetts, pp. 135–149.
- Franklin, I. R., F. W. Allendorf, and I.G. Jamieson. 2014. The 50/500 Rule Is Still Valid – Reply to Frankham et al. *Biological Conservation* 176:284–285.
- Hamilton, R. A. 2008. *2008 Surveys: Cactus Wrens and California Gnatcatchers, San Dieguito River Valley, San Diego County*. Prepared for Conservation Biology Institute.
- Hamilton, R. A., G. A. Proudfoot, D. A. Sherry, and S. Johnson. 2011. Cactus Wren (*Campylorhynchus brunneicapillus*). *The Birds of North America Online* (A. Poole, Ed.). Ithaca: <http://bna.birds.cornell.edu/bna/species/558>. DOI:10.2173/bna.558.
- Kamada, D., and K. Preston. 2013. *Nature Reserve of Orange County: Coastal Cactus Wren Dispersal and Survival Surveys, Genetics and Parasite Sampling, and Arthropod Foraging Ecology in 2012*. Final Report Prepared for California Department of Fish and Wildlife.
- Leatherman BioConsulting. 2009. *Central Reserve Cactus Wren Habitat Assessment and Study, 2008*. Prepared for Nature Reserve of Orange County.
- Mahrtdt, C. R., and K. L. Weaver. 2015. *2014 Bernardo Mountain Avian Surveys, San Dieguito River Park, San Diego County, California*. Prepared for San Dieguito River Park.
- Mahrtdt, C. R., and K. L. Weaver. 2016. *Bernardo Mountain Coastal Cactus Wren Survey, San Dieguito River Park, San Diego County, California*. Prepared for San Dieguito River Park.

- Mitrovich, M. J., and R. A. Hamilton. 2007. *Status of the Cactus Wren (Campylorhynchus brunneicapillus) within the Coastal Subregion of Orange County, California*. Prepared for the Nature Reserve of Orange County.
- Morrison, S. A., and D. T. Bolger. 2002. Variation in a Sparrow's Reproductive Success with Rainfall: Food and Predator Mediated Processes. *Oecologia* 133:315–324.
- Pratt, R. 2013. *Assessing the Importance of Arthropod Abundance, Community Composition, and Habitat Structure as Determinants of Habitat Quality for Cactus Wren (Campylorhynchus brunneicapillus)*. Presentation to the ESA.
- Preston, K. L., and J. T. Rotenberry. 2006. Independent Effects of Food and Predator-Mediated Processes on Annual Fecundity in a Songbird. *Ecology* 87:160–168.
- Preston, K. L., and D. Kamada. 2012. *Nature Reserve of Orange County: Monitoring Coastal Cactus Wren Reproduction, Dispersal and Survival, 2009-2011*. Final Report Prepared for the California Department of Fish and Game (LAG# PO982013) and the Nature Reserve of Orange County.
- Rea, A.M., and K. L. Weaver. 1990. The Taxonomy, Distribution, and Status Of Coastal California Cactus Wrens. *Western Birds* 21:81–126.
- Solek, C., and L. Szijj. 2004. Cactus Wren (*Campylorhynchus brunneicapillus*). In *The Coastal Sage Scrub and Chaparral Habitat and Associated Birds in California. California Partners in Flight*. <http://www.prbo.org/calpif/htmldocs/scrub.html>.
- TNC and SDMMP (The Nature Conservancy and San Diego Management and Monitoring Program). 2015. *South San Diego County Coastal Cactus Wren (Campylorhynchus brunneicapillus) Habitat Conservation and Management Plan*. Prepared for San Diego Association of Governments. Prepared by The Nature Conservancy in collaboration with San Diego Management and Monitoring Program.

USFWS (U.S. Fish and Wildlife Service). 2011. *Cactus Mapping and Cactus Wren Survey Results, 2009-11*. Microsoft Access Database.

USGS (U.S. Geological Survey). 2012. *United States Geological Survey 2012 Cactus Wren Survey Database*.

USGS. 2013. *United States Geological Survey 2013 Cactus Wren Survey Database*.

USGS. 2014. *United States Geological Survey 2014 Cactus Wren Survey Database*.

USGS. 2015. *United States Geological Survey 2015 Cactus Wren Survey and Monitoring Database*.

USGS. 2016. *United States Geological Survey 2015 Cactus Wren Monitoring Database*.

## 6.6 Northern Harrier (*Circus cyaneus*) – Category SO

### Management Units with Known Occurrences

The northern harrier is a state species of special concern and the only harrier in North America. Also known as the marsh hawk, it is found year-round in San Diego County though more numerous and widespread as a winter visitor than during the breeding season (Unitt 2004). The northern harrier breeds and forages in a variety of open habitats that provide adequate vegetative cover; an abundance of suitable prey; and scattered hunting, plucking, and lookout perches such as shrubs or fence posts. Such habitats include freshwater marshes; brackish and saltwater marshes; wet meadows; weedy borders of lakes, rivers, and streams; annual and perennial grasslands (including those with vernal pools); weed fields; ungrazed or lightly grazed pastures; some croplands; sagebrush flats; and desert sinks (MacWhirter and Bilstein 1996; J. Silveira in preparation.; J. Seay in preparation.; Davis and Niemela 2008). Northern harrier populations continue to decline due to numerous threats faced as described below.

On Conserved Lands, occurrences have been seen in MUs 1, 3, 4, 5, 6, 7, and 8. Unitt (2004) describes the Tijuana River estuary and valley as having the largest concentration of nesting harriers, with up to 13 pairs in MU1 at the Border Field State Park observed in 2002. During the 2009 breeding season, biologists found occurrences in MU1 at the Tijuana River Valley Regional Park (see Table of Occurrences). Baseline surveys at the Lawrence and Barbara Daley Preserve in MU3 had one observation of the harrier in 2010 (County of San Diego Department of Parks and Recreation 2011). In the spring of 2011, RECON biologists observed several occurrences in Otay Ranch Preserve located in MU3 (City of Chula Vista 2012) and once again in the spring and winter of 2013 (see Table of Occurrences).

### Management Categorization Rationale

The northern harrier should be managed as a Species Management Focus Category SO because persistence of one or more significant occurrences in the MSPA is at high risk of loss without immediate management action above and beyond that of daily maintenance activities and because management of grasslands and marshes alone will not ensure its persistence. The northern harrier should be managed at a species-specific level of management due to losses of productivity from active predator management aimed at protecting other declining species within the

MSPA, such as the California least tern and the Ridgway's rail (Davis and Niemela 2008).

The primary threat within the MSPA is the overall loss of degradation of nesting and foraging habitat due to urban development. Since the northern harrier nests on the ground, human use of preserves can cause nest failure because of the proximity of people walking near nests, off-leash dogs, and ORVs (Unitt 2004). Other threats include rodenticides, which may limit prey abundance and distribution, and invasive plants changing the landscape of their preferred nesting and foraging habitat. A potential threat to the harrier population in the MSPA may include the effects of prolonged drought from a changing climate, where breeding populations can vary with the amount of rainfall and the abundance of prey (Unitt 2004).

### **Management and Monitoring Approach**

The overarching goal for the northern harrier is to protect, enhance, and restore occupied and historically occupied habitat to create resilient, self-sustaining populations that provide for persistence over the long term (>100 years).

For the 2017–2021 planning cycle, the management and monitoring approach for the northern harrier is to:

- (1) conduct surveys in 2019 to determine species status and abundance, locate nesting areas, and document threats;
- (2) perform routine monitoring and management actions from 2017 through 2021;
- (3) prepare a management plan in 2020 based off data from previously performed surveys;
- (4) implement the highest-priority management actions for the northern harrier, and
- (5) monitor the implementation of the final management plan at the end of the planning cycle.

For details and the most up-to-date goals, objectives, and actions, go to the MSP Portal Northern Harrier summary page: [http://portal.sdmmp.com/view\\_species.php?taxaid=175430](http://portal.sdmmp.com/view_species.php?taxaid=175430)

### **Northern Harrier References**

City of Chula Vista. 2012. 2012-11 Baseline Survey Report for the Northern San Ysidro, McMillin, and Little Cedar Canyon Parcels of the Otay Ranch Preserve. Prepared by RECON Environmental, Inc., San Diego, CA.

County of San Diego Department of Parks and Recreation. 2011. Biological Diversity Baseline Report for the Lawrence and Barbara Daley Preserve, County of San Diego. Prepared by Technology Associates, San Diego, CA.

Davis, J. N., and C. A. Niemela. 2008. Northern Harrier. In Shuford, W. D., and Gardali, T., editors. California Bird Species of Special Concern: A Ranked Assessment of Species, Subspecies, and Distinct Populations of Birds of Immediate Conservation Concern in California. Studies of Western Birds 1. Western Field Ornithologists, Camarillo, California, and California Department of Fish and Game, Sacramento.

MacWhirter, R. B., and K. L. Bildstein. 1996. Northern Harrier (*Circus cyaneus*), in *Birds of North America* (A. Poole and F. Gill, eds.), no. 210. Acad. Nat. Sci., Philadelphia.

Unitt, P. 2004. *San Diego County Bird Atlas*. Proceedings of the San Diego Society of Natural History #39.



## **6.7 Southwestern Willow Flycatcher (*Empidonax traillii extimus*) – Category SL**

### **Management Units with Known Occurrences**

The southwestern willow flycatcher is 1 of 4 subspecies recognized in North America, with all 3 subspecies that occur in California listed as State Endangered. This particular subspecies is the only subspecies listed under the federal Endangered Species Act (USFWS 2014). Southwestern willow flycatcher has suffered severe declines throughout its range, which includes southern California, Arizona, New Mexico, southern Nevada, southern Utah southwestern Colorado, and southwestern Texas (USFWS 2014). Their current range in coastal southern California has experienced the overall largest proportion of decline in the number of known flycatcher territories since 1999, when there were 320 individuals documented in southern California. Although survey effort has not been uniform over the years, only 61 and 65 adults have been detected in 2016 and 2015, respectively. The drought and potential impacts on the wintering range are thought to be factors in this decline. The largest population is in the upper San Luis Rey River, where 46 birds were detected in 2015 and 48 in 2016 (Kus, unpublished data). The large Kern River population has crashed, with only a few males observed in the last several years and in the absence of females no breeding has been recorded. In comparison in San Diego County, there is a skewed adult sex ratio that favors females has resulted in polygyny, with a single male breeding with multiple females (Kus et al. 2016). As many as 10 females were able to breed with 2-3 males, allowing the species to persist in San Diego County (Kus et al. 2016).

In San Diego County, this subspecies is restricted to 2 modest colonies during the breeding season—the largest colony is located along the upper San Luis Rey River between the La Jolla Indian Reservation and East Grade Road (just below Lake Henshaw) and the other colony is located along the Santa Margarita River within MCB Camp Pendleton (Unitt 2004). To view a map of detections, see <http://arcg.is/2i913fK>.

### **Management Categorization Rationale**

The southwestern willow flycatcher should be managed as a Species Management Focus Category SL because persistence of 1 or more significant occurrences in the MSPA is at high risk of loss without immediate management action above and

beyond that of daily maintenance activities and because management of riparian habitat alone will not ensure its persistence.

Factors contributing to SL category status include loss and modification of riparian habitat, urbanization and agricultural developments, altered hydrological functions, and brood parasitism by the brown-headed cowbird (*Molothrus* sp.), which poses a particular threat in local population decline when combined with negative influences from predation and habitat loss (USFWS 2014). Additional threats include agricultural practices and heavy recreational use of flycatcher habitat (e.g., ORVs).

### **Management and Monitoring Approach**

The overarching goal for southwestern willow flycatcher is to protect, enhance, and restore occupied and historically occupied habitat to create resilient, self-sustaining populations that provide for persistence over the long term (>100 years).

For the 2017–2021 planning cycle, the management and monitoring approach for the southwestern willow flycatcher is to:

- (1) conduct breeding surveys along the upper San Luis Rey River and in other drainages through 2019 to determine southwestern willow flycatcher status within the MSPA;
- (2) Prepare a management plan with inclusive provisions for the reduction of potential impacts from SHB and/or *Fusarium* infestation in southwestern willow flycatcher occupied areas or potential habitat and incorporate SHB and/or *Fusarium* results determined from monitoring surveys into the plan, with a focus along the San Luis Rey River;
- (3) implement the highest priority management actions for southwestern willow flycatcher, and
- (4) monitor the success of the recommended management actions of the plan.

For details and the most up-to-date goals, objectives, and actions, go to the MSP Portal Southwestern Willow Flycatcher summary page: [http://portal.sdmmp.com/view\\_species.php?taxaid=712529](http://portal.sdmmp.com/view_species.php?taxaid=712529)

**Southwestern Willow Flycatcher References**

- Kus, B. E., S. L. Howell, and D. A. Wood. 2016. Female-biased sex ratio, polygyny, and persistence in the endangered Southwestern Willow Flycatcher (*Empidonax traillii extimus*). *The Condor* 119 :17, DOI :10.1650/CONDOR-16-119.1.
- Unitt, P. 2004. *San Diego County Bird Atlas*. Proceedings of the San Diego Society of Natural History #39.
- USFWS (U.S. Fish and Wildlife Service). 2014. *Southwestern Willow Flycatcher (Empidonax traillii extimus) 5-Year Review: Summary and Evaluation*. Phoenix Fish and Wildlife Office, Phoenix, Arizona.

## 6.8 Light-footed Ridgway's Rail (*Rallus obsoletus levipes*) – Category SO

### Management Units with Known Occurrences

The light-footed Ridgway's rail (formerly known as the light-footed clapper rail) is one of three subspecies found in California, with the California rail (*R. o. obsoletus*) solely found in San Francisco Bay marshes and the Yuma rail (*R. o. yumaensis*) inhabiting inland wetlands at the Salton Sea and on tributaries along the Colorado River (Zeiner et al. 1990). A federally and state-listed endangered species (FE, CE), the Ridgway's rail is a resident in coastal wetlands and lagoons in southern California and northern Baja California, Mexico (USFWS 2009). This large, hen-like marsh bird is elusive in nature and requires shallow water and mudflats for foraging (Zeiner et al. 1990).

In a collaborative group effort between federal, state, and local government agencies, along with help from the public, annual censuses have been conducted since 1980 among 37 California coastal wetlands (USFWS 2009). In 2016, the 37th annual census showed 357 pair detections in San Diego County, with the highest concentrations found in Tijuana Marsh National Wildlife Refuge, San Elijo Lagoon, and Batiquitos Lagoon (Zembal et al. 2016). Within the MSPA, these rails reside in MUs 1, 2, 6, and 7 (see online map: <http://arcg.is/2iBVOrS>).

### Management Categorization Rationale

The light-footed Ridgway's rail should be managed as a Species Management Focus Category SO because persistence of 1 or more significant occurrences in the MSPA is at high risk of loss without immediate management action above and beyond that of daily maintenance activities and because management of coastal wetlands alone will not ensure its persistence.

Factors contributing to this status include a highly limited range affected by the loss and degradation of habitat, disturbances due to altered hydrological conditions, and contaminants from urban runoff (USFWS 2009). Other threats to the Ridgway's rail include potentially low genetic diversity due to small population size, isolation from habitat fragmentation, and disturbances from human recreation. Though this rail is still faced with many threats, Zembal (2016) reports greater evidence of movement between marshes of this species.

## Management and Monitoring Approach

The overarching goal for the light-footed Ridgway's rail is to protect, enhance, and restore occupied and historically occupied habitat to create resilient, self-sustaining populations that provide for persistence over the long term (>100 years).

For the 2017–2021 planning cycle, the management and monitoring approach for the light-footed Ridgway's rail is to (1) monitor conserved occurrences annually from 2017 through 2021 to document abundance, record threats and to identify needed management actions based off various wildlife agencies monitoring programs; (2) inspect for necessary management recommendations; (2) implement routine management of vegetation and habitat determined during monitoring,

For details and the most up-to-date goals, objectives, and actions, go to the MSP Portal Ridgeway Rail summary page: [http://portal.sdmmp.com/view\\_species.php?taxaid=176211](http://portal.sdmmp.com/view_species.php?taxaid=176211).

## Light-footed Ridgway's Rail References

- USFWS (U.S. Fish and Wildlife Service). 2009. *Light-footed Clapper Rail (Rallus longirostris levipes) 5-Year Review: Summary and Evaluation*. Carlsbad Fish and Wildlife Office, Carlsbad, California, USA.
- Zeiner, D. C., W. F. Laudenslayer, K. E. Mayer, and M. White, eds. 1990. *California's Wildlife: Volume II - Birds*. California Department of Fish and Game. Sacramento, California.
- Zemba, R., S. F. Hoffman, and J. Konecny. 2016. *Status and Distribution of the Light-footed Ridgway's (Clapper) Rail in California*. California Department of Fish and Wildlife, South Coast Region, San Diego, California, USA.

## **6.9 California Least Tern (*Sternula antillarum browni*) – Category SO**

### **Management Units with Known Occurrences**

The California least tern is the smallest tern in North America and resides on the coasts, nesting on open beaches. One of the first federally and state-listed endangered species (FE, CE), the California least tern forages in bays and estuaries near their colonies, in the ocean nearshore, and at inland lakes in the coastal lowland (Unitt 2004).

Since 1973, CDFW has been conducting annual surveys of the California least tern. San Diego County's California least tern population rose significantly from a scant 500 pairs in the late 1970s to nearly 4,000 pairs in 2003 due in part to intensive studies, monitoring, and management (Unitt 2004). Southern California beaches are used more by California least terns for unknown reasons, even though viable, but disturbed, nesting habitat occurs north of Los Angeles County. Except for 1980 and 1981, San Diego County has contained the most populous clusters of breeding least terns (USFWS 2006). This subspecies has few nesting sites that are in a natural condition, such as the mouths of the Santa Margarita and Tijuana Rivers. Unfortunately, no beach is devoid of human recreation, development, or military pressure (Unitt 2004; USFWS 2006)

In 2015, 18 sites were surveyed throughout San Diego County (see online map: <http://arcg.is/2hnO8lg>), with the highest concentrations of estimated breeding pairs occurring within MCB Camp Pendleton. On Conserved Lands, in MUs 1, 6, and 7, Batiquitos Lagoon Ecological Reserve, Mariner's Point, Sweetwater Marsh National Wildlife Refuge, and Tijuana Estuary National Estuarine Research Reserve had estimations of over 100 breeding pairs each. FAA Island, North Fiesta Island, Stony Point, Chula Vista Wildlife Reserve, and South San Diego Bay/ San Diego National Wildlife Refuge -Saltworks all had estimations below 100 breeding pairs (CDFW 2016).

### **Management Categorization Rationale**

The California least tern should be managed as a Species Management Focus Category SO due to a high risk of loss of nesting territories from Conserved Lands in the MSPA and because management of its coastal habitat alone will not ensure its persistence. Management and monitoring of least terns should be based on

each individual area due to site-specific human-related issues and geographical or biological dictation of the general area or nesting site (CDFW 2016).

Factors contributing to the California least tern's Category SO status include a highly limited range affected by the loss and degradation of habitat, expansion of urban development, and disturbances due to human activities (e.g., people and/or their pets walking too close to nesting areas and/or entering nest sites, jet skiing in feeding zones, and military training exercises) (USFWS 1985). Other threats to California least tern include effects from climate change, disturbances due to altered hydrological conditions, and an increasing predator population, both native and introduced, which can cause a significant level of loss to a nesting colony in a matter of days or a single season. However, since some of the California least terns' predators are declining in populations themselves, such as the northern harrier and the western burrowing owl, management of predator control has become a balancing act (Unitt 2004). Since these threats are ongoing and difficult to eliminate, if at all, the California least tern is considered a "conservation-reliant species" due to its reliance on active and intensive conservation management (Scott et al. 2005; Scott and Goble 2006; USFWS 2006).

### **Management and Monitoring Approach**

The overarching goal for California least tern is protect, enhance, and restore occupied and historically occupied habitat to create resilient, self-sustaining populations that provide for persistence over the long term (>100 years).

For the 2017–2021 planning cycle, the management and monitoring approach for the California least tern is to (1) conduct predatory control at breeding colonies; (2) perform routine annual monitoring following protocols following the CDFW monitoring program; (3) inspect habitat of occurrences and document and management need, and (4) implement routine management of habitat as determined during monitoring of tern nesting sites.

For details and the most up-to-date goals, objectives, and actions, go to the MSP Portal California Least Tern summary page: [http://portal.sdmmp.com/view\\_species.php?taxaid=825084](http://portal.sdmmp.com/view_species.php?taxaid=825084).

## California Least Tern References

- CDFW (California Department of Fish and Wildlife). 2016. *California Least Tern Breeding Survey 2015 Season*. South Coast Region, San Diego, California, USA.
- Scott, J. M., and D. D. Goble. 2006. Ongoing Threats to Endemic Species. *Science* 312(5773):526–526.
- Scott, J. M., D. D. Goble, J. A. Wiens, D. S. Wilcove, M. Bean, and T. Male. 2005. Recovery of Imperiled Species under the Endangered Species Act: The Need for a New Approach. *Frontiers in Ecology and the Environment* 3(7):383–389.
- Unitt, P. 2004. *San Diego County Bird Atlas*. Proceedings of the San Diego Society of Natural History #39.
- USFWS (U.S. Fish and Wildlife Service). 1985. *Revised California Least Tern Recovery Plan*. U.S. Fish and Wildlife Service. Region 1. Portland, Oregon.
- USFWS. 2006. *California Least Tern (Sternula antillarum browni) 5-Year Review Summary and Evaluation*. Carlsbad Fish and Wildlife Office, Carlsbad, California.



## **6.10 Least Bell's Vireo (*Vireo bellii pusillus*) – Category SO**

### **Management Units with Known Occurrences**

The least Bell's vireo is a federally and state-endangered species originally thought to be 1 of 4 subspecies recognized by the American Ornithologists' Union (1957). However, recent research suggests the Bell's vireo is not 1 species with 4 subspecies, but 2 species, each with 2 subspecies, with results supporting the distinctiveness of the least Bell's vireo as a taxon (Klicka et al. 2016). This migratory songbird is dependent upon riparian habitat during the breeding season, with a large preference for willow-dominated woodland or scrub typically existing along streams or rivers (Wells and Kus 2001) in southern California and northwestern Baja California, Mexico. However, these vireos will also use marginal upland scrub adjacent to riparian woodland regularly whenever riparian woodland floods (Kus and Miner 1989; Unitt 2004).

USFWS (2006) reports that southern California supports 99% of the total population, with 54% in San Diego County and 30% in Riverside County. Surveys conducted by USGS from 2003 to 2015 in San Diego County indicate this species occurs in MUs 2,4,6,7, and 8 (see online map: <http://arcg.is/2i8ygbb>). Populations tend to concentrate in the coastal lowlands, especially along the Santa Margarita River, creeks within MCB Camp Pendleton, along the San Luis Rey River and its tributaries, San Dieguito River, Sweetwater River, Jamul and Dulzura Creeks, Otay River, and the Tijuana River valley; though there are occurrences in the foothills as well, such as at the San Diego River and Marron Valley (Unitt 2004).

### **Management Categorization Rationale**

The least Bell's vireo should be managed as a Species Management Focus Category SO because persistence of 1 or more significant occurrences in the MSPA is at high risk of loss without immediate management action above and beyond that of daily maintenance activities (SDMMP 2013) and because management of riparian habitat alone will not ensure its persistence.

Least Bell's vireos face a multitude of threats in southern California where a primary threat is the overall loss of riparian habitat, which can be attributed to urban development, and agricultural practices (USFWS 1998, 2006). Additional threats include altered hydrological conditions (e.g., flood control and

channelization), nest parasitism by the brown-headed cowbird (*Molothrus* sp.), and introduced species (e.g., tamarisk and giant reed). At both the regional and preserve levels, an indirect threat to these vireos appears to be the effects from SHB and *Fusarium* fungal invasion attacking multiple species of trees (see Vol. 2D, Sec. 6.0, Invasive Animals), which pose a threat to a number of different environments, in particular to native riparian habitats. Nest predation by Argentine ants may pose a potential threat to vireos in association with ongoing urbanization surrounding this species' preferred habitat, although it is unknown whether this threat will be serious in magnitude without further study (USFWS 2006).

### Management and Monitoring Approach

The overarching goal for least Bell's vireo is to protect, enhance, and restore occupied and historically occupied habitat to create resilient, self-sustaining populations that provide for persistence over the long term (>100 years).

For the 2017–2021 planning cycle, the management and monitoring approach for the least Bell's vireo is to (1) perform surveys through 2019 to document pre- and post- SHB and *Fusarium* outbreak effects on populations, with a focus on recovery in SHB-infested habitat over time at the Tijuana River site and conduct sampling at the MCBCP and San Luis Rey River sites; (2) develop a management plan dependent from results of surveys if indicative of necessary management of SHB and *Fusarium* impacts and incorporate prioritized monitoring and BMPs into management plan; (3) implement the highest priority management actions for least Bell's vireo, and (4) monitor the success of the recommended management actions.

For details and the most up-to-date goals, objectives, and actions, go to the MSP Portal Least Bell's Vireo summary page: [http://portal.sdmmp.com/view\\_species.php?taxaid=179007](http://portal.sdmmp.com/view_species.php?taxaid=179007).

### Least Bell's Vireo References

Klicka, L. B., B. E. Kus., and K. J. Burns. 2016. Conservation Genomics Reveals Multiple Evolutionary Units within Bell's Vireo (*Vireo bellii*). *Conservation Genetics* 17(2):455–471.

Kus, B. E., and K. L. Miner. 1989. *Use of Non-Riparian Habitats by Least Bell's Vireos*.

Unitt, P. 2004. *San Diego County Bird Atlas*. Proceedings of the San Diego Society of Natural History #39.

USFWS (U.S. Fish and Wildlife Service). 1998. *Draft Recovery Plan for Least Bell's Vireo*. U.S. Fish and Wildlife Service. Portland, Oregon. Prepared by the Portland Fish and Wildlife Office, Portland, Oregon.

USFWS. 2006. *Least Bell's Vireo (Vireo bellii pusillus) 5-Year Review: Summary and Evaluation*. Prepared by the Carlsbad Fish and Wildlife Office, Carlsbad, California.

This page intentionally left blank.

## 7.0 MAMMALS - SL, SO, SS

### 7.1 Pallid Bat (*Antrozous pallidus*) – Category SL

#### Management Units with Known Occurrences

Pallid bat is distributed from western Canada south to central Mexico and is found throughout much of California (Jameson and Peeters 1988). This species roosts in a variety of crevices and cavities from natural rock crevices, caves, and tree hollows to artificial structures such as bridges, tunnels, mines, and buildings (Stokes et al. 2005). They are most commonly found in abandoned mines in San Diego County and appear to be located wherever there are historical mining districts, including within the MSCP area (Sherwin 2005). In western San Diego County, pallid bat forages in oak savannah, grassy oak and sycamore terraces, native grasslands, and open scrublands. Historically, this species was widespread throughout the MSPA but has declined drastically in the last 50–60 years (Miner and Stokes 2005; Stokes et al. 2005).

Within the MSPA, the pallid bat has been detected at 13 preserves in MUs 3, 5, 8, 9, and 10 (see Table of Occurrences or online map: <http://arcg.is/2jZ4m8H>). There are 4 preserves with pallid bat observations in MU3, including Honey Springs Ranch in Jamul and Marron Valley in Dulzura. Two night roosts were documented with small numbers of individuals (1 to 6) at Dulzura Creek Bridge and Cottonwood Creek Cave #3 in the early 2000s (1 individual; Stokes et al. 2005); however, there were no pallid bat signs observed at the Dulzura Creek Bridge during the 2015–early 2016 survey (Stokes 2016). Pallid bats were observed foraging at these 2 preserves in the past, as well as in Hollenbeck Canyon Wildlife Area in MU3. Foraging pallid bats were detected at El Capitan (ICF Jones and Stokes 2008b), El Monte (ICF Jones and Stokes 2008a), and Boulder Oak Preserves (ICF Jones and Stokes 2007) in MU4, and at Boden Canyon Ecological Reserve and Ramona Grasslands Preserve in MU5. Foraging pallid bats have also been found at Mount Olympus and Wilderness Garden Preserves in MU8.

#### Management Categorization Rationale

Pallid bats should be managed as a Species Management Focus Category SL Species due to high risk of loss from Conserved Lands in the MSPA and because managing

vegetation alone will not ensure its persistence (see Vol. 1, Table 2-4). The pallid bat is at a high risk of loss from the MSPA as it is sensitive to urban development and has been lost from large areas of the MSPA where it occurred in the 1930s and 1940s (Miner and Stokes 2005; Stokes et al. 2005). It is currently known only in very small numbers in 4 MUs, and is at high risk of multiple threats (see Vol. 3, App. 1, Species Profiles).

The pallid bat has declined in the MSPA because of habitat loss and fragmentation, especially oak savannahs, native grassland, and open scrub vegetation communities, and because of extermination or disturbance of bat colonies (Miner and Stokes 2005; Stokes et al. 2005). The pallid bat is especially sensitive to urbanization and is extirpated from areas with more than rural development. Bats require multiple roosts with different temperature ranges to accommodate changing seasonal climate conditions, and these roosts need to be within nightly commute distances to foraging habitat. Bats are vulnerable to destruction of roosts (e.g., construction of water projects and transportation routes) or catastrophic events at roosts (e.g., fire, human disturbance) that adversely affect a large number of individuals at once. Recreational activities like cave or mine exploration and rock climbing near roosts can adversely affect reproductive success and survival, and can even cause bat colonies to abandon roosts (Miner and Stokes 2005).

Population recovery is slow as bats are relatively long-lived with low productivity. Pallid bats eat large, terrestrial insects, such as Jerusalem crickets and may be impacted by changes to habitat such as invasion of nonnative annual grasses and loss of bare ground (Stokes, pers. comm.). Pesticides can harm bats from ingestion of poisoned prey or by being sprayed inadvertently at day roosts (Miner and Stokes 2005). A warming and drying climate predicted for the arid southwest could also adversely affect reproduction by reducing surface water available for drinking by lactating bats (Adams and Hayes 2008). A recent study in an arid region of the west showed that lactating female bats visited water to drink 13 times more often than nonreproductive females. Modeling predicts that bat occurrences could decline with increasing aridity and warming forecast for the future.

### **Management and Monitoring Approach**

The overarching goal for pallid bat is to protect diurnal, nocturnal, and maternity roosts from destruction and human disturbance and enhance foraging habitat within commuting distance of nocturnal and maternity roosts to increase resilience

to environmental and demographic stochasticity, maintain genetic diversity, and improve chances of persistence over the long-term (>100 years).

For the 2017–2021 planning cycle, the management and monitoring approach is to:

- (1) Finalize the results of research begun in 2015 on pallid bat to identify nocturnal, diurnal, and maternity roosts, foraging areas, and water sources associated with roosts in order to identify seasonal and annual changes in use and important foraging areas, monitor reproductive status, collect habitat covariates associated with roosting and foraging habitat, and assess threats to bats at all preserves where they occur, and to develop management recommendations.
- (2) Inspect the vicinity of pallid bat roosts on an annual basis (see Table of Occurrences), taking care not to disturb bats, and use a regional monitoring protocol to collect covariate data on human activities and other threats to determine management needs. Perform routine management activities such as protecting occurrences from disturbance through fencing, signage, and enforcement.

For details and the most up-to-date goals, objectives, and actions, go to the MSP Portal [Pallid Bat summary page: https://portal.sdmmp.com/view\\_species.php?taxaid=180006](https://portal.sdmmp.com/view_species.php?taxaid=180006).

### **Pallid Bat References**

- Adams, Rick A., and Mark A. Hayes. 2008. Water Availability and Successful Lactation by Bats as Related to Climate Change in Arid Regions of Western North America. *Journal of Animal Ecology* 77(6):1115–121. DOI:10.1111/j.1365-2656.2008.01447.x.
- ICF Jones and Stokes. 2007. *Final Area Specific Management Directives for Boulder Oaks Open Space Preserve San Diego County Technical Appendices*. Prepared for the County of San Diego.
- ICF Jones and Stokes. 2008a. *Baseline Biological Resources Evaluation El Monte County Park*. Prepared for the County of San Diego.

- ICF Jones and Stokes. 2008b. *Baseline Biological Resources Evaluation for the El Capitan Preserve*. Prepared for the County of San Diego.
- Jameson, E. W., and H. J. Peeters. 1988. *California Mammals*. Berkeley, California: University of California Press.
- Miner, K. L., and D. C. Stokes. 2005. *Bats in the South Coast Ecoregion: Status, Conservation Issues, and Research Needs*. USDA Forest Service Gen. Tech. Rep. PSW-GTR-195.
- Sherwin, R. 2005. Townsend's Big-Eared Bat. Western Bat Working Group. <http://wbwg.org/western-bat-species/>.
- Stokes, D. C. 2016. *Progress Report for Focused Pallid Bat (*Antrozous Pallidus*) and Townsend's Big-Eared Bat (*Corynorhinus Townsendii*) Surveys in San Diego County, California*. Prepared for the San Diego Management and Monitoring Program and the United States Geological Survey.
- Stokes, D. C., C. S. Brehme, S. A. Hathaway, and R. N. Fisher. 2005. *Bat Inventory of the Multiple Species Conservation Program Area in San Diego County, California, 2002–2004*. U.S. Geological Survey, Western Ecological Research Center final report prepared for the County of San Diego and California Department of Fish and Game.



## 7.2 Stephens' Kangaroo Rat (*Dipodomys stephensi*) – Category SO

### Management Units with Known Occurrences

Endemic to southern California, the Stephens' kangaroo rat is a federally endangered and state-threatened (FE, CT), small nocturnal mammal native to open grasslands and sparse coastal sage scrub that consists of both native and nonnative herbs and grasses and filaree (USFWS 1997; Spencer 2005). Currently existing in fragmented populations disconnected by urban landscapes (Shier and Navarro n.d), these kangaroo rats can be found mostly in western Riverside County, extending south into northern San Diego County and possibly southwestern San Bernardino County (USFWS 1997). Within the MSPA, the Stephens' kangaroo rat has historically had occurrences in MUs 5, 6, 8, and 9 (see Table of Occurrences and online map: <http://arcg.is/2jxObno>). On Conserved Lands, 1 population can be found on the Ramona Grasslands Preserve in MU5. Other populations are found at MCB Camp Pendleton, Naval Weapons Station Fallbrook, Rancho Guejito, and Lake Henshaw/Warner Springs (Shier and Navarro n.d).

### Management Categorization Rationale

The Stephens' kangaroo rat should be managed as a Species Management Focus Category SO Species because persistence of one or more significant occurrences in the MSPA is at high risk of loss without immediate management action above and beyond that of daily maintenance activities and because management of its grassland habitat alone will not ensure its persistence. Because of limited occurrences of Stephens' kangaroo rat within the MSPA, the number of individuals present appears very small. Furthermore, the habitat for the portion of the occurrence in the MSPA is threatened by fragmentation by widespread urban and rural development and roads.

Threats to the Stephens' kangaroo rat include isolation, habitat fragmentation, loss of connectivity between occurrences, potentially low genetic diversity due to small population size, degradation of habitat quality, and predation from domestic cats (USFWS 2011). The increase of nonnative grasses and thatch in the MSPA has also inhibited movement of the species (USFWS 2011). Uses of traps and rodenticides, primarily associated with agricultural activities and control in residential areas and dam structures, has caused direct mortality (USFWS 1997).

## Management and Monitoring Approach

The overarching goal for Stephens' kangaroo rat is to protect, enhance, and restore occupied habitat and historically occupied habitat and the landscape connections between them to create resilient, self-sustaining populations that provide for persistence over the long term (>100 years).

For the planning cycle of 2017–2021, the management and monitoring approach is to inspect extant Stephens' kangaroo rat occurrences on Conserved Lands (see Table of Occurrences) using the regional rare plant IMG monitoring protocol to record abundance and collect habitat and threats covariate data to determine management needs. Conduct routine management actions as identified.

For details and the most up-to-date goals, objectives, and actions, go to the MSP Portal Stephens' Kangaroo Rat summary page: [https://portal.sdmmp.com/view\\_species.php?taxaid=180247](https://portal.sdmmp.com/view_species.php?taxaid=180247)

## Stephens' Kangaroo Rat References

Shier, D. M., and A. Navarro. n.d. Range-wide Genetics of the Stephens' Kangaroo rat (*Dipodomys Stephensi*). Final Report. 33 pp.

Spencer, W. D. 2005. Stephens' Kangaroo Rat Survey. Conservation Biology:2.

USFWS (U.S. Fish and Wildlife Service). 1997. Draft recovery plan for the Stephen's kangaroo rat. Portland, OR.

USFWS. 2011. Stephen's Kangaroo Rat (*Dipodomys stephensi*) 5-Year Review: Short Form Summary. Carlsbad Fish and Wildlife Office, Carlsbad, California, USA.

### 7.3 Southern Mule Deer (*Odocoileus hemionus fuliginatus*) – Category SS

#### Management Units with Known Occurrences

The southern mule deer (*Odocoileus hemionus fuliginatus*) is 1 of 6 subspecies of mule deer found in California. The range of the southern mule deer extends south of Los Angeles County into northern Baja California, Mexico (CDFW 2015). In the MSPA, southern mule deer have been documented in MUs 3, 4, 5, 6, 7, 8, 9, and 10 (see online map: <http://arcg.is/2hpnKu1>). Southern mule deer are adapted to a variety of habitats in western San Diego County, including woodlands, shrublands, meadows, grasslands, and riparian areas. Shrub habitats and woodlands interspersed with meadows or grasslands are important for food resources, as well as cover for shade and protection from predators. Southern mule deer are mobile but nonmigratory. They prefer to move through areas where there is high vegetative cover, such as ridgetops or riparian corridors, and typically avoid areas of sparse vegetative cover, agricultural areas, urban areas, and areas with high levels of human activity. Access to dependable water sources is important for mule deer, especially during the summer. Home ranges for southern mule deer in San Diego County are generally small (average 49 hectares), which is 2 to 20 times smaller than home ranges estimated for other subspecies of mule deer elsewhere in California (Kie et al. 2002).

Mule deer have been documented in the MSPA through various track and camera monitoring efforts, including those by the San Diego Tracking Team, Conservation Biology Institute (CBI 2002, 2003), City of Carlsbad (2015), USGS (Rochester in prep.), and others. Deer movement and connectivity within the MSPA have been assessed using noninvasive genetic sampling of deer scat. This research revealed significant population genetic structure and low levels of movement and gene flow (Mitelberg and Vandergast 2016; Bohonak and Mitelberg, unpublished report).

#### Management Categorization Rationale

Southern mule deer should be managed as a Species Management Focus Category SS Species, because their persistence is at lower risk of loss compared to SL and SO species; however, this species still requires species-specific management actions (see Vol. 1, Table 2-4).

Habitat loss and fragmentation by urbanization and roads are the leading threat to southern mule deer and could result in local extirpation without appropriate

conservation measures. Roads are a major barrier to movement as well as a significant source of direct mortality. A study of deer genetics in San Diego County found evidence for limited dispersal, a population structure that corresponds to major freeways, and population bottlenecks within the past 60 years (Bohanek and Mitelberg, unpublished data). Climatic changes, such as drought, play a key role in declines in mule deer populations (Wilson et al. 2005).

Genetic studies of deer identified that major highways are restricting mule deer connectivity (Bohanak and Mitelberg 2014; Mitelberg and Vandergast 2016). Highways, in particular, are isolating mule deer populations in the western part of the MSPA, where populations generally correspond to existing reserves and canyons. Bohanek and Mitelberg (2014) identified two regional populations using genetic clustering techniques: a western and an eastern population, with evidence of a mixed population assignment in the vicinity of SR 67. The area around SR 67 is characterized by a transition from dense suburban development to the west to more rural development with large areas of open space to the east (Mitelberg and Vandergast 2016). The genetic data indicate deer have high family group home range affinity with most female young occupying at least a portion of their mother's home range as adults. Male deer moved farther but did not disperse widely. Genetic structuring of the population is occurring indicating that some linkages may not be functioning for deer. Torrey Pines, Sorrento Valley, Peñasquitos Canyon, Peñasquitos Creek, Carrol Canyon, MCAS Miramar, and Mission Trails may be considered as a separate management unit from those elsewhere in the subspecies range (Bohanek and Mitelberg 2014).

In addition to genetic studies, track and camera studies completed by the City of Carlsbad in 2015 documented the presence of southern mule deer in isolated habitat fragments within the city; it is unclear if connectivity to larger habitat patches east of Carlsbad are being maintained (City of Carlsbad 2015).

### **Management and Monitoring Approach**

The overarching goal for southern mule deer is to enhance and expand areas occupied in San Diego County within suitable natural vegetation surrounded by a limited number of high use roads, and increase connectivity (and reduce potential road mortality) between occupied and suitable habitat areas to allow expansion and movement of southern mule deer occurrences and to ensure persistence in the MSPA over the long term (>100 years).

For the 2017–2021 planning cycle, the management and monitoring approach for southern mule deer will focus on completing a genetic analysis of the species in the northern portion of the MSPA and using the results of these and past regional genetic studies to identify barriers to deer movement, and to identify and implement measures to improve deer connectivity.

Beginning in 2018, genetic studies will be initiated for southern mule deer in MUs 7, 8, 9, and 10 to determine gene flow as well as possible barriers to connectivity. West of Interstate 5, these studies will help identify how deer that have been documented in habitat fragments are moving between fragments as well as to larger conserved areas to the east.

Deer genetic studies will inform the preparation of Linkage Evaluations for mountain lions and other species in MUs 8, 9, and 10. Linkage evaluations will inform the preparation of Linkage Management Plans, which will identify specific locations and recommendations for improving deer connectivity, where feasible. Deer genetic studies, Linkage Evaluations, and Linkage Management Plans will inform the identification and implementation of near-term connectivity enhancements for mule deer in MUs 7, 8, 9, and 10, such as wildlife fencing, culvert maintenance, or wildlife crossing structure improvement.

For details and the most up-to-date goals, objectives, and actions, go to the MSP Portal Southern Mule Deer summary page: [http://portal.sdmmp.com/view\\_species.php?taxaid=898459](http://portal.sdmmp.com/view_species.php?taxaid=898459)

### **Southern Mule Deer References**

- Bohonak, A., and A. Mitelberg. 2014. *Final Report: Social Structure and Genetic Connectivity in the Southern Mule Deer: Implications for Management*. Prepared for California Department of Fish and Wildlife. April 16, 2014. SDSURF Fund 57103A; CDFW grant agreement P1182117.
- CBI (Conservation Biology Institute). 2002. *Wildlife Corridor Monitoring Study for the MSCP*. Prepared for City of Poway, City of San Diego, and California Department of Fish and Game.
- CBI. 2003. *Review of Regional Habitat Linkage Monitoring Locations, MSCP*. Prepared for the California Department of Fish and Game. NCCP Local Assistance Grant #P0050009, Task A.

- City of Carlsbad, Environmental Science Associates, Center for Natural Lands Management. 2015. *Final Report: City of Carlsbad Wildlife Movement Analysis*. Prepared for California Department of Fish and Wildlife. March 31, 2015. CDFW grant agreement No. P1282107.
- Kie, J. G., R. T. Bowyer, M. C. Nicholson, B. B. Boroski, and E. R. Loft. 2002. *Landscape Heterogeneity at Differing Scales: Effects on Spatial Distribution of Mule Deer*. *Ecology* 83:530–544.
- Mitelberg, A. and A. G. Vandergast. 2016. *Non-Invasive Genetic Sampling of Southern Mule Deer (Odocoileus hemionus fuliginatus) Reveals Limited Movement Across California State Route 67 in San Diego County*. *Western Wildlife* 3:8–18.
- Wilson, Don E.; and D. M. Reeder, eds. 2005. *Mammal Species of the World: A Taxonomic and Geographic Reference*, [Online]. 3rd ed. Baltimore, MD: Johns Hopkins University Press. 2,142 pp. Washington, DC: Smithsonian National Museum of Natural History, Department of Vertebrate Zoology, Division of Mammals; American Society of Mammalogists.

## **7.4 Townsend's Big-eared Bat (*Plecotus townsendii pallescens*) – Category SO**

### **Management Units with Known Occurrences**

Townsend's big-eared bat is widely distributed in North America and was formally common throughout California, except in subalpine and alpine habitats (Harris 2000). This bat roosts in caves, mines, tunnels, bridges, abandoned buildings, and other human made structures (Harris 2000; Stokes et al. 2005). They are most commonly found in abandoned mines in San Diego County and appear to be located wherever there are historic mining districts, including within the MSCP area (Sherwin 2005). In western San Diego County, Townsend's big-eared bat forages in oak woodland and riparian habitats, where it specializes on moths close to the vegetation and may even glean insects off the plant leaves. Historically, this species was widespread from the coast to the desert in San Diego County, but is now rare and only occurs in the foothills and mountains (Miner and Stokes 2005; Stokes et al. 2005). In the 1970s, a survey of 12 maternity colonies active in San Diego County during the 1930s and 1940s found only 1 which was still active.

Within the MSPA, Townsend's big-eared bat has been detected at 15 preserves in MUs 3, 4, 5, 6, 9, 10, and 11 (see Table of Occurrences or online map: <http://arcg.is/2jZ8ZiW>), 6 of which are in MU3. There was a single individual observed roosting at the Dulzura Creek Bridge during a 2015–early 2016 survey (Stokes 2016). A large diurnal roost of 100 bats was discovered at Cottonwood Tunnel. During the 2015–early 2016 survey, Townsend's big-eared bats were detected at Sloan Canyon, Proctor Valley, Marron Valley, Long Potrero, Honey Springs Ranch, Hollenbeck Canyon, Hwy 94 Bridge in Jamul, Otay Mountain Mines, Cleveland National Forest Mines, and Barret Flume.

In MU4, Townsend's big-eared bats were detected roosting in an old abandoned mine at El Capitan Preserve and a female with evidence of having raised young was mist netted at the Oakoasis Preserve. This species was also detected foraging at Hellhole Canyon Preserve in MU5, where there is suitable roosting habitat and the most species-rich bat community documented in the MSPA since 2000. In MU6, Townsend's big-eared bat was detected foraging at Del Dios Highland Preserve, making this the most recent westerly observation for this species in the MSPA.

There are 11 recent (>2000) detections of Townsend's big-eared bat east of the MSPA boundaries in the Cleveland National Forest extending from the U.S.-Mexican Border north to the San Diego-Riverside County line.

### **Management Categorization Rationale**

Townsend's big-eared bat should be managed as a Species Management Focus Category SO Species due to high risk of loss from Conserved Lands in the MSPA and because managing vegetation alone will not ensure its persistence (see Vol. 1, Table 2-4). Townsend's big-eared bat is at a moderate risk of loss from the MSPA as the species has declined since the 1940s, is highly sensitive to disturbance at roosts, and occurs in relatively small numbers (see Vol. 3, App. 1, Species Profiles).

Townsend's big-eared bat has declined in the MSPA because of habitat loss and fragmentation, especially oak woodland and riparian vegetation communities, and because of extermination or disturbance of bat colonies (Miner and Stokes 2005; Stokes et al. 2005). Bats require multiple roosts with different temperature ranges to accommodate changing seasonal climate conditions, and these roosts need to be within nightly commute distances to foraging habitat. Bats are vulnerable to destruction of roosts (e.g., construction of water projects and transportation facilities, etc.) or catastrophic events at roosts (e.g., fire, human disturbance) that adversely affect a large number of individuals at once. Recreational activities like cave or mine exploration and rock climbing near roosts can adversely affect reproductive success and survival, and can cause bat colonies to abandon roosts (Miner and Stokes 2005). Townsend's big-eared bat is especially sensitive to human disturbance at roosts.

Population recovery is also slow as bats are relatively long-lived with low productivity (Miner and Stokes 2005). Townsend's bats forage in riparian areas, specializing on moths near vegetation, so they may be susceptible to pesticides applied for mosquito abatement. Pesticides can cause harm to bats from ingestion of poisoned prey or by being sprayed inadvertently at day roosts.

A warming and drying climate predicted for the arid southwest could also adversely affect reproduction by reducing surface water available for drinking by lactating bats (Adams and Hayes 2008). A recent study in an arid region of the west showed that lactating female bats visited water to drink 13 times more often than nonreproductive females. Modeling predicts that bat occurrences could decline with increasing aridity and warming forecast for the future.



## Management and Monitoring Approach

The overarching goal for Townsend's big-eared bat is to protect diurnal, nocturnal, and maternity roosts from destruction and human disturbance and enhance foraging habitat within commuting distance of nocturnal and maternity roosts to increase resilience to environmental and demographic stochasticity, maintain genetic diversity, and improve chances of persistence over the long term (>100 years).

For the 2017–2021 planning cycle, the management and monitoring approach is to:

- (1) Finalize the results of research begun in 2015 on Townsend's big-eared bat to identify nocturnal, diurnal, and maternity roosts, foraging areas, and water sources associated with roosts in order to identify seasonal and annual changes in use and important foraging areas, monitor reproductive status, collect habitat covariates associated with roosting and foraging habitat, and assess threats to bats at all preserves where they occur, and to develop management recommendations.
- (2) Inspect the vicinity of Townsend's big-eared bat roosts on an annual basis (see Table of Occurrences), taking care not to disturb bats, and use a regional monitoring protocol to collect covariate data on human activities and other threats to determine management needs.
- (3) Perform routine management activities such as protecting occurrences from disturbance through fencing, signage, and enforcement.

For details and the most up-to-date goals, objectives, and actions, go to the MSP Portal Townsend's Big-eared Bat summary page: [https://portal.sdmmp.com/view\\_species.php?taxaid=203457](https://portal.sdmmp.com/view_species.php?taxaid=203457)

## Townsend's Big-eared Bat References

Adams, Rick A., and Mark A. Hayes. 2008. Water Availability and Successful Lactation by Bats as Related to Climate Change in Arid Regions of Western North America. *Journal of Animal Ecology* 77(6):1115–121. DOI:10.1111/j.1365-2656.2008.01447.x.

- Harris, J. 2000. *California Wildlife Habitat Relationships System Species Account for Townsend's Big-Eared Bat*. Prepared for California Department of Fish and Game California Interagency Wildlife Task Group.
- Miner, K. L., and D. C. Stokes. 2005. *Bats in the South Coast Ecoregion: Status, Conservation Issues, and Research Needs*. USDA Forest Service Gen. Tech. Rep. PSW-GTR-195.
- Sherwin, R. 2005. Townsend's Big-Eared Bat. Western Bat Working Group. <http://wbwg.org/western-bat-species/>.
- Stokes, D. C. 2016. *Progress Report for Focused Pallid Bat (*Antrozous Pallidus*) and Townsend's Big-Eared Bat (*Corynorhinus Townsendii*) Surveys in San Diego County, California*. Prepared for the San Diego Management and Monitoring Program and the United States Geological Survey.
- Stokes, D. C., C. S. Brehme, S. A. Hathaway, and R. N. Fisher. 2005. *Bat Inventory of the Multiple Species Conservation Program Area in San Diego County, California, 2002–2004*. U.S. Geological Survey, Western Ecological Research Center final report prepared for the County of San Diego and California Department of Fish and Game.

## **7.5 Mountain Lion (*Puma concolor*) – Category SL**

### **Management Units with Known Occurrences**

The mountain lion (*Puma concolor*), also known as puma, catamount, and cougar, is San Diego County's widest ranging carnivore. In the United States, their current range is restricted to the 12 westernmost states and Florida. Mountain lions are a protected species in California and are adapted to a variety of habitats, including shrublands, woodlands, grasslands, and deserts. In the MSPA, locations for mountain lions are primarily derived from research by U.C. Davis since 2001 that found mountain lions largely restricted to more rugged terrain that remains largely uninhabited by humans in MUs 3, 4, 5, 8, 9, and 10 (Vickers in preparation).

Research over the past 15 years within San Diego, Riverside, and Orange Counties conducted by the U.C. Davis Wildlife Health Center has included studies of mountain lion movements, predator-prey interactions, interactions with humans and domestic animals, and exposure to disease and environmental toxins. This research project combined camera, Global Positioning System collar, and mortality data with state-of-the-art genetic analyses and modeling to produce the most comprehensive assessment to date of mountain lion connectivity within and adjacent to the MSP.

### **Management Categorization Rationale**

Mountain lions should be managed as a Species Management Focus Category SL Species due to a high risk of loss from the MSPA and because managing habitat alone will not ensure persistence of the species.

Mountain lions are under threat in southern California on multiple fronts. In the MSPA, the majority of threats are related to genetic isolation, roads, further habitat loss and fragmentation, and inadequate livestock husbandry practices that lead to loss of mountain lions via depredation permits (Vickers in preparation).

Research by U.C. Davis indicates that annual survival rates of mountain lions in the region are very low (estimated at 56%) with vehicle strikes and depredation permits being the leading causes (Vickers et al. 2015). Depredation permits, which are authorized after a mountain lion kills a domestic animal, have increased during the past 4 years of study (2013–2016) over previous levels, with 14 mountain lions being killed between 2014 and 2016 (Vickers in preparation). Mortality caused by

vehicular strikes is the second highest cause of mountain lion death in San Diego County. Highways in the study area that contain sections that are partial barriers to movement or present higher risks for vehicle strikes include Interstates 8 and 15, Valley Center Road (S6), SR 67, SR 78, Wildcat Canyon / Barona Road, and SR 94 (Vickers 2014). In particular, Interstate 15 in the northern part of the MSPA is a major barrier to mountain lion movement between the Santa Ana Mountains and the eastern Peninsular Range (Palomar mountains) (Ernest et al. 2014; Vickers et al. 2015). The few lions (estimated 20–30 individuals) remaining in the Santa Ana Mountains are increasingly isolated and their persistence is threatened by low survival rates and a lack of genetic variability (Ernest et al. 2014; Vickers et al. 2015).

The wide-ranging nature of the species dictates the necessity for travel across unprotected open space as well as many road crossings for most mountain lions. Both travel across un-conserved lands and road crossings put mountain lions at increased risk from human-associated mortality causes. High levels of mortality and genetic isolation raise serious concerns about long-term sustainability of the mountain lion population in the region.

Mountain lion IMAs are identified on the online map at: <http://arcg.is/2jx4iBP>, and represent critical choke points where research and management should be focused to improve and protect regional connectivity.

### **Monitoring and Management Approach**

The overarching goal for mountain lion is to enhance and expand areas occupied in San Diego County in large interconnected blocks (>1,000 acres) of suitable natural vegetation surrounded by a limited number of high use roads, and increase connectivity (and reduce potential road mortality) between occupied and suitable habitat areas to allow expansion and movement of mountain lion occurrences within San Diego County and adjacent counties. This would increase effective population size to sustainable levels and work to reduce depredation on livestock to ensure persistence in the MSPA over the long term (>100 years).

Management and monitoring efforts within the MSP during the 2017–2021 planning cycle will focus on using past research results to inform management and monitoring actions to enhance connectivity and reduce mortality from depredation permits and vehicle strikes. Management objectives for the 2017–2021 planning cycle are summarized below. For details and the most up-to-date goals, objectives,

and actions, go to the MSP Portal Mountain Lion summary page: [http://portal.sdmmp.com/view\\_species.php?taxaid=552479](http://portal.sdmmp.com/view_species.php?taxaid=552479)

#### Conduct Linkage Assessments

For the 2017–2021 planning cycle, mountain lion movement data collected over the past 15 years will be used to model landscape use and movement in MUs 5, 8, 9, and 10, particularly where highways have been shown to be barriers to lion movement between protected areas. Modeling data will be used to define key movement areas along major roads where detailed linkage assessments will be performed. Linkage assessments will identify (1) blocks of habitat to be connected by the linkage, (2) specific areas of focus for connectivity planning/linkage design, and (3) the current level of permeability and specific barriers to lion movement within focal linkage areas.

#### Prepare Mountain Lion Connectivity Management Plan

Linkage assessments will inform the development of a Mountain Lion Connectivity Management Plan for priority mountain lion movement areas in MUs 5, 8, 9, and 10. The Management Plan will identify spatially explicit linkage design for each priority movement area, as well as specific actions to improve or protect lion connectivity (e.g., location and design of wildlife road crossing improvements, land acquisition, wildlife fencing). The Mountain Lion Connectivity Management Plan will consider the needs of deer where feasible. Planning and design of linkages should incorporate linkage design procedures developed by Beier et al. (2008) and Beier and Brost (2010) as available data and time allow.

#### Test and Implement Best Practices for Hazing Native Predators

Research will also be conducted to inform the development and implementation of BMPs for reducing mountain lion and other native predator predation on domestic livestock in an effort to reduce depredation permits. Research will focus on developing and testing various hazing devices to deter mountain lions from preying on domestic livestock. BMPs for deterring native predators from preying on domestic wildlife will be promoted in locations where depredation permits have been issued in the past and will be further monitored to evaluate their effectiveness.

#### Develop and Implement a Long-Term Mountain Lion Monitoring Program

A long-term mountain lion monitoring strategy will be developed and implemented that incorporates an array of best practices, including noninvasive

genetic sampling, camera traps, and collection of lion mortality data to document mountain lion movement, identify problem areas, and inform management actions.

#### Implement Regional Mountain Lion Management Coordination

Because the mountain lion is a wide-ranging species whose persistence is dependent on maintaining connectivity to areas to the north and east of the MSP, the monitoring and management approach for mountain lion will include maintaining cooperative efforts aimed at enhancing regional habitat connectivity with stakeholders in San Diego, Orange, and Riverside Counties (e.g., Tri County Inter-Agency Connectivity Coordination Coalition).

#### **Mountain Lion References**

- Beier, P. 2008. Learning Like a Mountain. *The Wildlife Professional* 1:26–29.
- Beir, P., and B. Brost. 2010. Use of Land Facets to Plan for Climate Change: Conserving the Arenas, Not the Actors. *Conservation Biology* 24:701–710.
- Beier, P., D. R. Majka, and W. D. Spencer. 2008. Forks in the Road: Choices in Procedures for Designing Wildlife Linkages. *Conservation Biology* 22:836–851.
- Ernest, H. B., T. W. Vickers, S. A. Morrison, and W. M. Boyce. 2014. Fractured Genetic Connectivity Threatens a Southern California Puma (*Puma concolor*) Population. *PLoS ONE* 9(10): e107985. DOI:10.1371/journal.pone.0107985.
- Vickers, T. W. 2014. *Mountain Lion Connectivity Study*. Prepared for the San Diego Association of Governments.
- Vickers, T. W., J. N. Sanchez, C. K. Johnson, S. A. Morrison, R. Botta, T. Smith, B. S. Cohen, P. R. Huber, H. B. Ernest, and W. M. Boyce. 2015. Survival and Mortality of Pumas (*Puma concolor*) in a Fragmented, Urbanizing Landscape. *PLoS ONE* 10(7): e0131490. DOI:10.1371/journal.pone.0131490.

## 7.6 American Badger (*Taxidea taxus*) – Category SL

### Management Units with Known Occurrences

American badgers are mid-sized predators occurring in low densities in grasslands and open shrublands with sandy loamy soils (Brehme et al. 2012). Locations for badger detections are mainly derived from biological reports from preserves and surveys conducted by USGS in 2011 and 2014 using a combination of the USGS Badger Hotline and canines trained in scent detection. American badger has been detected in MUs 3, 4, 5, 6, 9, 10, and 11 since 2009. In 2015, USGS continued studies of spatial and temporal use of badger habitats and discovered live badger activity at 2 sites, one in MU5 at Rancho Guejito and the other in MU4 along the upper San Diego River at El Capitan Grande Reservation (USGS 2015 in draft). Since 2003, American badgers have been detected sporadically in MUs 3, 5, and 6 (see online map: <https://arcg.is/1n59mL>). Because the badger is a wide-ranging species, a Badger Important Conservation Area has been delineated on the map to focus management across preserve complexes rather than at individual preserves. There are also reports since the year 2000 of badgers in Mission Trails Regional Park in MU4 and Los Peñasquitos Canyon in MU6 (C. Brehme, pers. comm.). There have been no recent detections of American badger in MUs 1, 2, 7, and 8. Suitable habitat appears to be present in MU8 relatively close to locations in MUs 3, 5, and 6 where badgers were detected by USGS in 2011.

Large areas of MU3 were recently surveyed by USGS for American badger and it was only detected at 3 preserves: Crestridge Ecological Reserve, Hollenbeck Canyon Wildlife Area, and Marron Valley Mitigation Bank (see online map). There is an unconfirmed report of a badger burrow on Otay Mesa East (Furby-North; Technology Associates and Environmental Science 2011). Scat at the entrance to the burrow tested negative for badger (C. Brehme, pers. comm.). MU3 contains large contiguous areas of suitable conserved habitat for badgers. The species was also detected at Ramona Grasslands Open Space Preserve in MU5 where there are large blocks of grassland vegetation connected to areas of suitable habitat farther to the north and east. In MU6, American badger was detected at Daley Ranch Open Space Preserve, which contains large blocks of grassland vegetation and is connected to areas of suitable habitat farther to the south and east. All of the preserves where badgers were detected, except for Marron Valley, have high-volume traffic roadways immediately adjacent or very close to them.

## **Management Categorization Rationale**

American badger should be managed as a Species Management Focus Category SL Species due to a high risk of loss from Conserved Lands in the MSPA and because managing grasslands alone will not ensure persistence of the species (see Vol. 1, Table 2-4). American badger is at a high risk of loss from the MSPA as there are limited occurrences, the number of individuals present appears very small, and the habitat for the portion of the occurrence within the MSPA is fragmented by urban and rural development and roads. The species is in decline and faces a high risk of threats. While the American badger would normally be a habitat management species, because of the current status of the occurrence within and adjacent to the MSPA, it was elevated to a species-specific management species to increase management efforts and reduce the potential that it will be extirpated from the MSPA.

Threats to badger include roads with mortality due to vehicular accidents and fragmentation of habitat, and loss of connectivity between occurrences and potentially reduced food supply (ground squirrels and other fossorial species). American badgers may be susceptible to new generation rodenticides obtained indirectly through ingestion of prey. Invasive plant species may reduce suitable habitat and prey (e.g., ground squirrels). Human use of preserves can cause direct mortality, disturbance to burrows, and disruption of daily activities (Adams et al. 2002; Quinn 2008). Although CDFW (previously known as CDFG) has designated badgers as a Species of Special Concern (e.g., its occurrence is declining at a rate that could result in it becoming threatened or endangered if efforts to slow its declines are not successful; CDFG 2011) the California Fish and Game Commission has authorized its take as a furbearer and, during the badger take season, there is no bag limit. The impacts to the MSP badger from the take authorized by the California Fish and Game Commission is unknown (CDFG 2008; CFGC 2013).

## **Management and Monitoring Approach**

The overarching goal for American badger is to protect, enhance, and restore occupied and historically occupied habitat to create resilient, self-sustaining populations that provide for persistence over the long term (>100 years).

Because of the wide-ranging nature and natural low densities of American badger, persistence within the MSPA will require management for badgers both within,



and on, lands to the east and north of the MSPA boundary within the range of the western subspecies of badger (*Taxidea taxus jeffersonii*) in San Diego County. Due to recent studies revealing badger detections across the region, management actions should be prioritized in areas representative of suitable badger vegetation. Suitable habitat appears to be present in MUs 4 and 8 in close to areas in MUs 3, 5, and 6 where badgers were detected by USGS in 2011. Further surveys in MUs 4 and 8 should be conducted and, if badger is detected, these MUs should also be prioritized for management.

For the 2017–2021 planning cycle, the management and monitoring approach for the American badger is to:

- (1) Continue the study begun in 2014 to: determine the locations of American badgers in western San Diego County (see Table of Occurrences); to assess and analyze occurrence status, identify and characterize suitable habitat, and evaluate threats; to record movement patterns to determine the risk of direct mortality from existing and planned future roads; and to examine ways to improve badger connectivity between IMAs and reduce mortality (e.g., culverts, bridges, fencing, etc.). Use the study results to prepare specific recommendations for badger habitat management and for connectivity enhancement within the MSPA.
- (2) Continue the study begun in 2014 to determine the population genetics of American badger in western San Diego County (see Table of Occurrences), within the range of *T. t. Jeffersoni*, to determine the extent of connectivity between badger occurrences and, if possible, the number and relationship of existing individuals, and use this information to determine where to prioritize connectivity enhancements and whether, existing occurrences of American badger are self-sustaining.
- (3) Use data and recommendations from the research and genetic studies to develop a long-term American Badger Monitoring Plan in the MSPA to efficiently and periodically monitor the distribution, abundance, mortality, and connectivity of the badger population using noninvasive and cost-efficient monitoring methods, such as the collection of scat for genetic analysis, tracking, and burrow surveys. The plan should include specific monitoring objectives, sampling frame, sampling design, methods and analytic approach.

- (4) Use results and recommendations from the research and genetic studies to develop a 2022–2026 comprehensive American Badger Management Plan in the MSPA to enhance connectivity within and among IMAs (see Table of Occurrences) and to manage grasslands to improve habitat quality and prey availability. The plan should identify high-priority areas for badger management and provide site-specific management recommendations and guidelines for monitoring the effectiveness of management actions.

For details and the most up-to-date goals, objectives, and actions, go to the MSP Portal American Badger summary page: [https://portal.sdmmp.com/view\\_species.php?taxaid=180565](https://portal.sdmmp.com/view_species.php?taxaid=180565).

### **American Badger References**

- Adams, I., T. Antifeau, M. Badry, L. Campbell, A. Dibb, O. Dyer, W. Erickson, C. Hoodicoff, L. Ingham, A. Jackson, K. Larsen, T. Munson, N. Newhouse, B. Persello, J. Surgenor, K. Sutherland, J. Steciw, and R. Weir. 2002. Draft National Recovery Strategy for American Badger, *jeffersonii* subspecies, (*Taxidea taxus jeffersonii*). Recovery of Nationally Endangered Wildlife, Ottawa, Ont.
- Brehme, C. S., C. Rochester, S. A. Hathaway, B. H. Smith, and R. N. Fisher. 2012. Rapid Assessment of the Distribution of American Badgers within Western San Diego County. Data Summary prepared for California Department of Fish and Game. 42 pp.
- CDFG (California Department of Fish and Game). 2008. California Department of Fish and Game Trapping License Examination Reference Guide. <http://www.dfg.ca.gov/wildlife/hunting/uplandgame/docs/CADFGTrappingGuideJan2009.pdf>.
- CDFG. 2011. State of California, The Natural Resources Agency, Department of Fish and Game, Biogeographic Data Branch, California Natural Diversity Database, Special Animals. January 2011.
- CFGC (California Fish and Game Commission). 2013. Mammal Hunting Regulations 2013-2014. <http://www.fgc.ca.gov/regulations/current/mammalregs.aspx#460>

- Quinn, J. 2008. The Ecology of the American badger (*Taxidea taxus*) in California: Assessing Conservation Status on Multiple Scales. Ph.D. Dissertation. The University of California Davis, Davis, CA. 200 pp.
- Technology Associates and Environmental Science Associates. 2011. Biological Diversity Baseline Report for the Furby-North Property. Prepared for the San Diego County Department of Parks and Recreation.
- USGS (U.S. Geological Survey). 2014. Research of American Badgers in Western San Diego County. San Diego Field Station, California, USA. Prepared for California Department of Fish and Wildlife and San Diego Association of Governments.
- USGS. 2015. Research Results for American Badgers in Western San Diego County- in Draft. San Diego Field Station, California, USA. Prepared for San Diego Association of Governments.

This page intentionally left blank.

***FINAL***

**Management and Monitoring  
Strategic Plan for Conserved Lands in  
Western San Diego County:  
*A Strategic Habitat Conservation  
Roadmap***

***Volume 3: Appendices***

**2017**



## APPENDIX 1

### MSP SPECIES AND VEGETATION PROFILES

#### A. LINKS TO SPECIES PROFILES

**Table V3.App1A: Links to Species Profiles.**

Scientific Name	Common Name	Management Category	Links to Species Profiles
<b>Plants</b>			
<i>Acanthomintha ilicifolia</i>	San Diego thorn-mint	SO	<a href="https://portal.sdmmp.com/species_profile.php?taxaid=32426">https://portal.sdmmp.com/species_profile.php?taxaid=32426</a>
<i>Acmispon prostrates</i>	Nuttall's acmispon	SO	<a href="https://portal.sdmmp.com/species_profile.php?taxaid=820047">https://portal.sdmmp.com/species_profile.php?taxaid=820047</a>
<i>Agave shawii</i> var <i>shawii</i>	Shaw's agave	SL	<a href="https://portal.sdmmp.com/species_profile.php?taxaid=810342">https://portal.sdmmp.com/species_profile.php?taxaid=810342</a>
<i>Ambrosia pumila</i>	San Diego ambrosia	SO	<a href="https://portal.sdmmp.com/species_profile.php?taxaid=36517">https://portal.sdmmp.com/species_profile.php?taxaid=36517</a>
<i>Aphanisma blitoides</i>	Aphanisma	SL	<a href="https://portal.sdmmp.com/species_profile.php?taxaid=20679">https://portal.sdmmp.com/species_profile.php?taxaid=20679</a>
<i>Arctostaphylos glandulosa</i> ssp. <i>Crassifolia</i>	Del Mar manzanita	VF	<a href="https://portal.sdmmp.com/species_profile.php?taxaid=183557">https://portal.sdmmp.com/species_profile.php?taxaid=183557</a>
<i>Arctostaphylos otayensis</i>	Otay manzanita	VF	<a href="https://portal.sdmmp.com/species_profile.php?taxaid=23507">https://portal.sdmmp.com/species_profile.php?taxaid=23507</a>
<i>Arctostaphylos rainbowensis</i>	Rainbow manzanita	VF	<a href="https://portal.sdmmp.com/species_profile.php?taxaid=507811">https://portal.sdmmp.com/species_profile.php?taxaid=507811</a>
<i>Baccharis vanessae</i>	Encinitas baccharis	SO	<a href="https://portal.sdmmp.com/species_profile.php?taxaid=183764">https://portal.sdmmp.com/species_profile.php?taxaid=183764</a>
<i>Bloomeria clevelandii</i>	San Diego goldenstar	SS	<a href="https://portal.sdmmp.com/species_profile.php?taxaid=509575">https://portal.sdmmp.com/species_profile.php?taxaid=509575</a>
<i>Brodiaea filifolia</i>	Thread-leaved brodiaea	SS	<a href="https://portal.sdmmp.com/species_profile.php?taxaid=42806">https://portal.sdmmp.com/species_profile.php?taxaid=42806</a>
<i>Brodiaea orcuttii</i>	Orcutt's brodiaea	SO	<a href="https://portal.sdmmp.com/species_profile.php?taxaid=42815">https://portal.sdmmp.com/species_profile.php?taxaid=42815</a>
<i>Brodiaea santarosae</i>	Santa Rosa brodiaea	SS	<a href="https://portal.sdmmp.com/species_profile.php?taxaid=810190">https://portal.sdmmp.com/species_profile.php?taxaid=810190</a>
<i>Ceanothus cyaneus</i>	Lakeside ceanothus	VF	<a href="https://portal.sdmmp.com/species_profile.php?taxaid=28461">https://portal.sdmmp.com/species_profile.php?taxaid=28461</a>

## Appendix 1. Species and Vegetation Community Profiles

Scientific Name	Common Name	Management Category	Links to Species Profiles
<i>Ceanothus verrucosus</i>	Wart-stemmed ceanothus	VF	<a href="https://portal.sdmmp.com/species_profile.php?taxaid=28518">https://portal.sdmmp.com/species_profile.php?taxaid=28518</a>
<i>Chloropyron maritimum</i> ssp. <i>Maritimum</i>	Salt marsh bird's-beak	SL	<a href="https://portal.sdmmp.com/species_profile.php?taxaid=834234">https://portal.sdmmp.com/species_profile.php?taxaid=834234</a>
<i>Chorizanthe orcuttiana</i>	Orcutt's spineflower	SL	<a href="https://portal.sdmmp.com/species_profile.php?taxaid=21019">https://portal.sdmmp.com/species_profile.php?taxaid=21019</a>
<i>Clinopodium chandleri</i>	San Miguel savory	SL	<a href="https://portal.sdmmp.com/species_profile.php?taxaid=565077">https://portal.sdmmp.com/species_profile.php?taxaid=565077</a>
<i>Cylindropuntia californica</i> var. <i>californica</i>	Snake cholla	VF	<a href="https://portal.sdmmp.com/species_profile.php?taxaid=913470">https://portal.sdmmp.com/species_profile.php?taxaid=913470</a>
<i>Dicranostegia orcuttiana</i>	Orcutt's bird's-beak	SL	<a href="https://portal.sdmmp.com/species_profile.php?taxaid=834156">https://portal.sdmmp.com/species_profile.php?taxaid=834156</a>
<i>Dudleya blochmaniae</i>	Blochman's dudleya	SL	<a href="https://portal.sdmmp.com/species_profile.php?taxaid=502165">https://portal.sdmmp.com/species_profile.php?taxaid=502165</a>
<i>Dudleya brevifolia</i>	Short-leaved dudleya	SL	<a href="https://portal.sdmmp.com/species_profile.php?taxaid=502166">https://portal.sdmmp.com/species_profile.php?taxaid=502166</a>
<i>Dudleya variegata</i>	Variegated dudleya	SS	<a href="https://portal.sdmmp.com/species_profile.php?taxaid=502182">https://portal.sdmmp.com/species_profile.php?taxaid=502182</a>
<i>Dudleya viscida</i>	Sticky dudleya	SS	<a href="https://portal.sdmmp.com/species_profile.php?taxaid=502185">https://portal.sdmmp.com/species_profile.php?taxaid=502185</a>
<i>Ericameria palmeri</i> ssp. <i>Palmeri</i>	Palmer's goldenbush	VF	<a href="https://portal.sdmmp.com/species_profile.php?taxaid=527914">https://portal.sdmmp.com/species_profile.php?taxaid=527914</a>
<i>Erysimum ammophilum</i>	Coast wallflower	SL	<a href="https://portal.sdmmp.com/species_profile.php?taxaid=22928">https://portal.sdmmp.com/species_profile.php?taxaid=22928</a>
<i>Euphorbia misera</i>	Cliff spurge	VF	<a href="https://portal.sdmmp.com/species_profile.php?taxaid=28104">https://portal.sdmmp.com/species_profile.php?taxaid=28104</a>
<i>Ferocactus viridescens</i>	San Diego barrel cactus	VF	<a href="https://portal.sdmmp.com/species_profile.php?taxaid=19801">https://portal.sdmmp.com/species_profile.php?taxaid=19801</a>
<i>Fremontodendron mexicanum</i>	Mexican flannelbush	SL	<a href="https://portal.sdmmp.com/species_profile.php?taxaid=21581">https://portal.sdmmp.com/species_profile.php?taxaid=21581</a>
<i>Hazardia orcuttii</i>	Orcutt's hazardia	SL	<a href="https://portal.sdmmp.com/species_profile.php?taxaid=502882">https://portal.sdmmp.com/species_profile.php?taxaid=502882</a>
<i>Hesperocyparis forbesii</i>	Tecate cypress	VF	<a href="https://portal.sdmmp.com/species_profile.php?taxaid=822589">https://portal.sdmmp.com/species_profile.php?taxaid=822589</a>
<i>Lepechinia cardiophylla</i>	Heart-leaved pitcher sage	SL	<a href="https://portal.sdmmp.com/species_profile.php?taxaid=32553">https://portal.sdmmp.com/species_profile.php?taxaid=32553</a>
<i>Monardella hypoleuca</i> ssp. <i>lanata</i>	Felt-leaved monardella	VF	<a href="https://portal.sdmmp.com/species_profile.php?taxaid=524318">https://portal.sdmmp.com/species_profile.php?taxaid=524318</a>
<i>Monardella stoneana</i>	Jennifer's monardella	SL	<a href="https://portal.sdmmp.com/species_profile.php?taxaid=832834">https://portal.sdmmp.com/species_profile.php?taxaid=832834</a>
<i>Monardella viminea</i>	Willow monardella	SL	<a href="https://portal.sdmmp.com/species_profile.php?taxaid=833060">https://portal.sdmmp.com/species_profile.php?taxaid=833060</a>
<i>Nolina cismontane</i>	Chaparral nolina	SL	<a href="https://portal.sdmmp.com/species_profile.php?taxaid=507567">https://portal.sdmmp.com/species_profile.php?taxaid=507567</a>



Scientific Name	Common Name	Management Category	Links to Species Profiles
<i>Nolina interrata</i>	Dehesa nolina	SO	<a href="https://portal.sdmmp.com/species_profile.php?taxaid=42992">https://portal.sdmmp.com/species_profile.php?taxaid=42992</a>
<i>Packera gander</i>	Gander's ragwort	SO	<a href="https://portal.sdmmp.com/species_profile.php?taxaid=565357">https://portal.sdmmp.com/species_profile.php?taxaid=565357</a>
<i>Quercus dumosa</i>	Nuttall's scrub oak	VF	<a href="https://portal.sdmmp.com/species_profile.php?taxaid=19323">https://portal.sdmmp.com/species_profile.php?taxaid=19323</a>
<i>Quercus engelmannii</i>	Engelmann Oak	VF	<a href="https://portal.sdmmp.com/species_profile.php?taxaid=19329">https://portal.sdmmp.com/species_profile.php?taxaid=19329</a>
<i>Rosa minutifolia</i>	Small-leaved rose	SS	<a href="https://portal.sdmmp.com/species_profile.php?taxaid=504824">https://portal.sdmmp.com/species_profile.php?taxaid=504824</a>
<i>Tetracoccus dioicus</i>	Parry's tetracoccus	SS	<a href="https://portal.sdmmp.com/species_profile.php?taxaid=28420">https://portal.sdmmp.com/species_profile.php?taxaid=28420</a>
<b>Invertebrates</b>			
<i>Euphydryas editha quino</i>	Quino checkerspot butterfly	SL	<a href="https://portal.sdmmp.com/species_profile.php?taxaid=779299">https://portal.sdmmp.com/species_profile.php?taxaid=779299</a>
<i>Euphyes vestris harbisoni</i>	Harbison's dunn skipper	SL	<a href="https://portal.sdmmp.com/species_profile.php?taxaid=707282">https://portal.sdmmp.com/species_profile.php?taxaid=707282</a>
<i>Lycaena hermes</i>	Hermes copper	SL	<a href="https://portal.sdmmp.com/species_profile.php?taxaid=777791">https://portal.sdmmp.com/species_profile.php?taxaid=777791</a>
<i>Panoquina errans</i>	Wandering skipper	VF	<a href="https://portal.sdmmp.com/species_profile.php?taxaid=706557">https://portal.sdmmp.com/species_profile.php?taxaid=706557</a>
<b>Fish</b>			
<i>Gila orcuttii</i>	Arroyo chub	SL	<a href="https://portal.sdmmp.com/species_profile.php?taxaid=553278">https://portal.sdmmp.com/species_profile.php?taxaid=553278</a>
<b>Amphibians</b>			
<i>Anaxyrus californicus</i>	Arroyo toad	SO	<a href="https://portal.sdmmp.com/species_profile.php?taxaid=773514">https://portal.sdmmp.com/species_profile.php?taxaid=773514</a>
<b>Reptiles</b>			
<i>Emys pallida</i>	Southwestern pond turtle	SL	<a href="https://portal.sdmmp.com/species_profile.php?taxaid=668677">https://portal.sdmmp.com/species_profile.php?taxaid=668677</a>
<b>Birds</b>			
<i>Agelaius tricolor</i>	Tricolored blackbird	SL	<a href="https://portal.sdmmp.com/species_profile.php?taxaid=179060">https://portal.sdmmp.com/species_profile.php?taxaid=179060</a>
<i>Aquila chrysaetos Canadensis</i>	Golden eagle	SO	<a href="https://portal.sdmmp.com/species_profile.php?taxaid=175408">https://portal.sdmmp.com/species_profile.php?taxaid=175408</a>
<i>Athene cunicularia hypugaea</i>	Western burrowing owl	SL	<a href="https://portal.sdmmp.com/species_profile.php?taxaid=687093">https://portal.sdmmp.com/species_profile.php?taxaid=687093</a>
<i>Campylorhynchus brunneicapillus sandiegensis</i>	Coastal cactus wren	SO	<a href="https://portal.sdmmp.com/species_profile.php?taxaid=917698">https://portal.sdmmp.com/species_profile.php?taxaid=917698</a>

## Appendix 1. Species and Vegetation Community Profiles

Scientific Name	Common Name	Management Category	Links to Species Profiles
<i>Charadrius nivosus nivosus</i>	Western snowy plover	SL	<a href="https://portal.sdmmp.com/species_profile.php?taxaid=824565">https://portal.sdmmp.com/species_profile.php?taxaid=824565</a>
<i>Circus cyaneus</i>	Northern harrier	SO	<a href="https://portal.sdmmp.com/species_profile.php?taxaid=175430">https://portal.sdmmp.com/species_profile.php?taxaid=175430</a>
<i>Empidonax traillii extimus</i>	Southwestern willow flycatcher	SL	<a href="https://portal.sdmmp.com/species_profile.php?taxaid=712529">https://portal.sdmmp.com/species_profile.php?taxaid=712529</a>
<i>Poliophtila californica californica</i>	Coastal California gnatcatcher	VF	<a href="https://portal.sdmmp.com/species_profile.php?taxaid=925072">https://portal.sdmmp.com/species_profile.php?taxaid=925072</a>
<i>Rallus obsoletus levipes</i>	Light-footed Ridgway's rail	SO	<a href="https://portal.sdmmp.com/species_profile.php?taxaid=176211">https://portal.sdmmp.com/species_profile.php?taxaid=176211</a>
<i>Sternula antillarum browni</i>	California least tern	SO	<a href="https://portal.sdmmp.com/species_profile.php?taxaid=825084">https://portal.sdmmp.com/species_profile.php?taxaid=825084</a>
<i>Vireo bellii pusillus</i>	Least Bell's vireo	SO	<a href="https://portal.sdmmp.com/species_profile.php?taxaid=179007">https://portal.sdmmp.com/species_profile.php?taxaid=179007</a>
<b>Mammals</b>			
<i>Antrozous pallidus</i>	Pallid bat	SL	<a href="https://portal.sdmmp.com/species_profile.php?taxaid=180006">https://portal.sdmmp.com/species_profile.php?taxaid=180006</a>
<i>Dipodomys stephensi</i>	Stephens' kangaroo rat	SO	<a href="https://portal.sdmmp.com/species_profile.php?taxaid=180247">https://portal.sdmmp.com/species_profile.php?taxaid=180247</a>
<i>Odocoileus hemionus fuliginata</i>	Southern mule deer	SS	<a href="https://portal.sdmmp.com/species_profile.php?taxaid=898459">https://portal.sdmmp.com/species_profile.php?taxaid=898459</a>
<i>Plecotus townsendii pallescens</i>	Townsend's big-eared bat	SO	<a href="https://portal.sdmmp.com/species_profile.php?taxaid=203457">https://portal.sdmmp.com/species_profile.php?taxaid=203457</a>
<i>Puma concolor</i>	Mountain lion	SL	<a href="https://portal.sdmmp.com/species_profile.php?taxaid=552479">https://portal.sdmmp.com/species_profile.php?taxaid=552479</a>
<i>Taxidea taxus</i>	American badger	SL	<a href="https://portal.sdmmp.com/species_profile.php?taxaid=180565">https://portal.sdmmp.com/species_profile.php?taxaid=180565</a>

**B. LINKS TO VEGETATION COMMUNITY PROFILES****Table V3.App1B: Links to Vegetation Community Profiles.**

Veg Community	Link to Profile
<b>Coastal Sage Scrub</b>	<a href="https://portal.sdmmp.com/veg_community_profile.php?taxaid=SDMMP_vegcom_1">https://portal.sdmmp.com/veg_community_profile.php?taxaid=SDMMP_vegcom_1</a>
<b>Oak Woodland</b>	<a href="https://portal.sdmmp.com/veg_community_profile.php?taxaid=SDMMP_vegcom_10">https://portal.sdmmp.com/veg_community_profile.php?taxaid=SDMMP_vegcom_10</a>
<b>Dunes &amp; Coastal Bluffs</b>	<a href="https://portal.sdmmp.com/veg_community_profile.php?taxaid=SDMMP_vegcom_13">https://portal.sdmmp.com/veg_community_profile.php?taxaid=SDMMP_vegcom_13</a>
<b>Grassland</b>	<a href="https://portal.sdmmp.com/veg_community_profile.php?taxaid=SDMMP_vegcom_2">https://portal.sdmmp.com/veg_community_profile.php?taxaid=SDMMP_vegcom_2</a>
<b>Chaparral</b>	<a href="https://portal.sdmmp.com/veg_community_profile.php?taxaid=SDMMP_vegcom_3">https://portal.sdmmp.com/veg_community_profile.php?taxaid=SDMMP_vegcom_3</a>
<b>Vernal Pool/Alkali Playa</b>	<a href="https://portal.sdmmp.com/veg_community_profile.php?taxaid=SDMMP_vegcom_4">https://portal.sdmmp.com/veg_community_profile.php?taxaid=SDMMP_vegcom_4</a>
<b>Freshwater Marsh</b>	<a href="https://portal.sdmmp.com/veg_community_profile.php?taxaid=SDMMP_vegcom_5">https://portal.sdmmp.com/veg_community_profile.php?taxaid=SDMMP_vegcom_5</a>
<b>Salt Marsh</b>	<a href="https://portal.sdmmp.com/veg_community_profile.php?taxaid=SDMMP_vegcom_6">https://portal.sdmmp.com/veg_community_profile.php?taxaid=SDMMP_vegcom_6</a>
<b>Riparian Forest &amp; Scrub</b>	<a href="https://portal.sdmmp.com/veg_community_profile.php?taxaid=SDMMP_vegcom_7">https://portal.sdmmp.com/veg_community_profile.php?taxaid=SDMMP_vegcom_7</a>
<b>Torrey Pine Forest</b>	<a href="https://portal.sdmmp.com/veg_community_profile.php?taxaid=SDMMP_vegcom_8">https://portal.sdmmp.com/veg_community_profile.php?taxaid=SDMMP_vegcom_8</a>
<b>Southern Interior Cypress Forest</b>	<a href="https://portal.sdmmp.com/veg_community_profile.php?taxaid=SDMMP_vegcom_9">https://portal.sdmmp.com/veg_community_profile.php?taxaid=SDMMP_vegcom_9</a>

This page intentionally left blank.

## **APPENDIX 2**

### **BEST MANAGEMENT PRACTICES SUPPORTING DOCUMENTS**

#### **A. CACTUS RESTORATION**

1. TNC and SDMMP. 2015. South San Diego County Coastal Cactus Wren (*Campylorhynchus brunneicapillus*) Habitat Conservation and Management Plan. Prepared for San Diego Association of Governments. Prepared by The Nature Conservancy in collaboration with San Diego Management and Monitoring Program.

[https://portal.sdmmp.com/view\\_article.php?cid=CiteID\\_1603251358358990](https://portal.sdmmp.com/view_article.php?cid=CiteID_1603251358358990)

2. Dodero, M. 1998. Guidelines for Cactus Salvage and Propagation. Prepared by Mark Dodero, RECON Environmental Inc. 10/20/08. PDF. 4 pages.

[https://portal.sdmmp.com/view\\_article.php?cid=CID\\_ctamanah%40usgs.gov\\_574db20e618cb](https://portal.sdmmp.com/view_article.php?cid=CID_ctamanah%40usgs.gov_574db20e618cb)

3. Hamilton, R. 2009. Restoration Guidelines for "Coastal" Cactus Wrens. Updated 5-04-09. Prepared by Robert A. Hamilton, Hamilton Biological. Commissioned by the Conservation Biology Institute and The Nature Conservancy. PPT. 84 slides.

[https://portal.sdmmp.com/view\\_article.php?cid=CID\\_ctamanah%40usgs.gov\\_574db2f5d1450](https://portal.sdmmp.com/view_article.php?cid=CID_ctamanah%40usgs.gov_574db2f5d1450)

#### **B. SEED COLLECTION**

1. Way, M. and K. Gold. 2008. Assessing a Potential Seed Collection. Millennium Seed Bank Project KEW. Technical Information Sheet\_02. Board of Trustees of the Royal Botanic Gardens, Kew. West Sussex. PDF. 2 pages.

[https://portal.sdmmp.com/view\\_article.php?cid=CID\\_eperkins@usgs.gov\\_58db06116e703](https://portal.sdmmp.com/view_article.php?cid=CID_eperkins@usgs.gov_58db06116e703)

2. Way, M. and K. Gold. 2008. Seed Collecting Techniques. Millennium Seed Bank Project KEW. Technical Information Sheet\_03. Board of Trustees of the Royal Botanic Gardens, Kew. West Sussex. PDF. 2 pages.

[https://portal.sdmmp.com/view\\_article.php?cid=CID\\_eperkins@usgs.gov\\_58db071d30d13](https://portal.sdmmp.com/view_article.php?cid=CID_eperkins@usgs.gov_58db071d30d13)

3. Kew. 2001. Field Manual for Seed Collectors: Seed Collecting for the Millennium Seed Bank Project, Royal Botanic Gardens, Kew. PDF. 21 pages.

[https://portal.sdmmp.com/view\\_article.php?cid=CID\\_eperkins@usgs.gov\\_58db07d2b3e50](https://portal.sdmmp.com/view_article.php?cid=CID_eperkins@usgs.gov_58db07d2b3e50)

4. Wall, Michael. 2009. Seed Collection Guidelines for California Native Plant Species. Prepared for Rancho Santa Ana Botanic Garden. PDF. 25 pages.

[https://portal.sdmmp.com/view\\_article.php?cid=CID\\_eperkins@usgs.gov\\_58db096f2a71f](https://portal.sdmmp.com/view_article.php?cid=CID_eperkins@usgs.gov_58db096f2a71f)

## **C. WEED REMOVAL**

1. Conservation Biology Institute. 2014. "Brachypodium Control: Experimental Treatments to Control Brachypodium An Adaptive Approach for Conserving Endemic Species San Diego County, California."

[https://portal.sdmmp.com/view\\_article.php?cid=CiteID\\_1603251358356560](https://portal.sdmmp.com/view_article.php?cid=CiteID_1603251358356560)

2. Land IQ, and Conservation Biology Institute. 2015. "South County Grasslands Project Phase 2 2015 Final Report." San Diego, California.  
  
[https://portal.sdmmp.com/view\\_article.php?cid=CID\\_201604011922\\_132](https://portal.sdmmp.com/view_article.php?cid=CID_201604011922_132)
3. Tu, M., Hurd, C. and J.M. Randall. 2001. Weed Control Methods Handbook, The Nature Conservancy, <http://tncweeds.ucdavis.edu>, version: April 2001. PDF. 219 pages.  
  
[https://portal.sdmmp.com/view\\_article.php?cid=CID\\_eperkins@usgs.gov\\_58db0b2e86a2a](https://portal.sdmmp.com/view_article.php?cid=CID_eperkins@usgs.gov_58db0b2e86a2a)
4. DiTomaso, J.M., G.B. Kyser, and M.J. Pitcairn. 2006. Yellow Starthistle Management Guide. Cal-IPC Publication 2006-03. California Invasive Plant Council: Berkeley, CA. 78 pp. Available: [www.cal-ipc.org](http://www.cal-ipc.org).  
  
[https://portal.sdmmp.com/view\\_article.php?cid=CID\\_eperkins@usgs.gov\\_58db0b8753641](https://portal.sdmmp.com/view_article.php?cid=CID_eperkins@usgs.gov_58db0b8753641)

This page intentionally left blank.